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POWER PLANT OF THE BOSTON SAFE DEPOSIT AND TRUST COMPANY

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LOCATED IN THE NEW office building of the Boston Safe Deposit and Trust Co., at the corner of Franklin and Devonshire Streets, is a compact and very complete power plant, which has been in operation for the past few months. The building is 9 stories in height, above the street level, with ground dimensions approximating 125 by 135 ft.

General Arrangement

RELATIVE locations of the various parts of the equipment are best illustrated in Fig. 2, which shows that part of the building occupied by the power plant. The boiler room occupies a rear corner of the sub-basement, and besides the boilers, contains the feed-water heater, vacuum and the boiler-feed pumps, and hot-water heating tank. The mechanical draft apparatus is also located in this room, although not

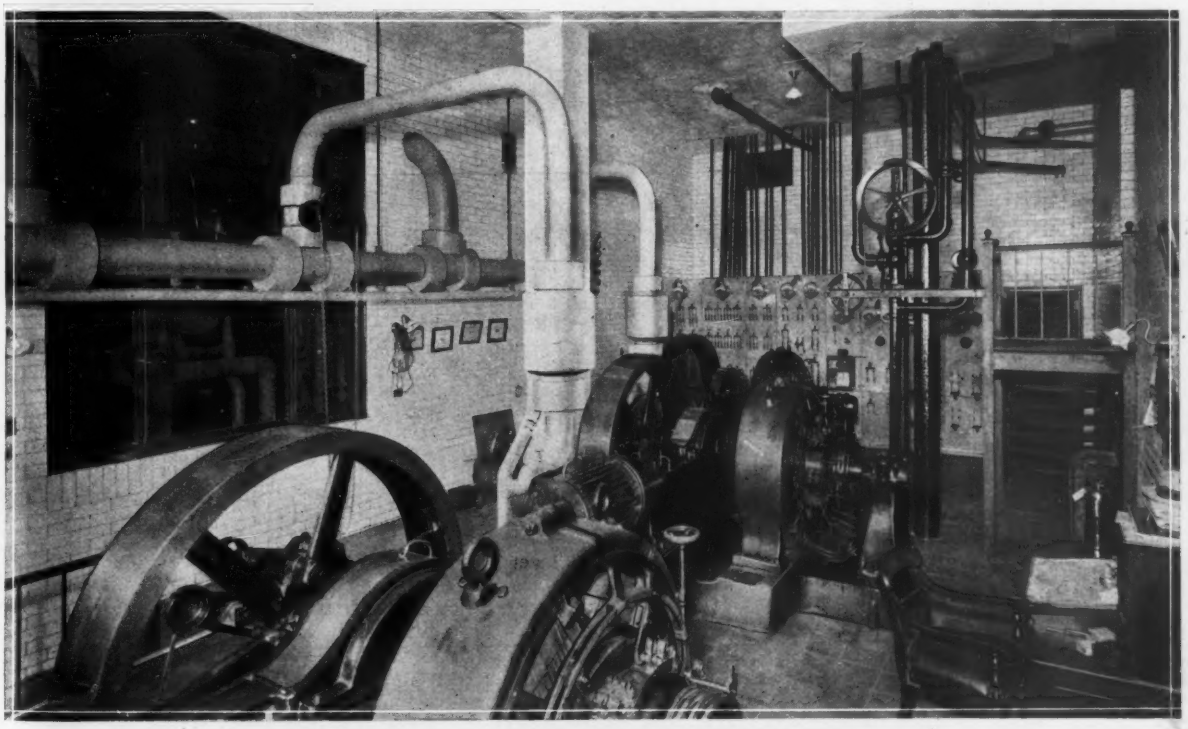


FIG. 8. VIEW OF GENERATING UNITS AND SWITCHBOARD

The power and ventilating plant is located in the sub-basement, the boiler room being about 40 ft. below the level of the sidewalk.

The engine and pump rooms are at a somewhat higher elevation in order to provide a space for the heavy exhaust piping beneath the floor.

shown on the plans. The chimney stack is at the rear, directly back of the boilers, and the hydraulic ash lift in the rear left-hand corner.

At the right of the boiler room and reached by a short flight of iron stairs, is the engine room, containing 3 generating units, located as shown. The engines

are supplied from a large main supported upon the boiler room wall and receiving steam at each end, being supplied from 2 separate drums connected with the boilers, thus giving 2 paths for the steam in case of accident or repairs. The elevator pumps and tanks are located in a room in the right-hand rear corner of the building, there being 2 main pumps, 2 pressure tanks, and an open tank in this room.

The ventilating equipment, although not being strictly a part of the power plant, is shown in outline in a room adjoining the pump room, and consists of a tempering coil, air washer and humidifier, a main heater for raising the air to the desired temperature for ventilating purposes, and an electrically driven supply fan for delivering the air to the building.

FIG. 1. BOSTON SAFE DEPOSIT AND TRUST CO. BUILDING

An interesting feature, also shown in Fig. 2, is the method employed for cooling and ventilating the boiler, engine, and pump rooms. In order to prevent overheating the rooms in the basement directly above the boiler room, an 18-in. space is provided, and this is connected with a fan system for supplying cool air from out of doors, and is also furnished with a vent opening discharging into the brick flue surrounding the iron boiler stack. This arrangement has sufficient capacity to change the air in this space every 2 min.

In addition to this, fresh cool air is blown directly into the boiler room through galvanized iron ducts with outlets looking down, as shown in the elevation. This not only cools the room, but also furnishes air for combustion in the furnaces, the boiler room being so far below the street level, the inleakage of air in sufficient quantities cannot be depended upon for this purpose. Cool air from the same system of ducts is supplied along 1 side of the engine room through wall registers near the floor and the hot air is drawn off from a point near the ceiling and discharged into the large vent uptake surrounding the boiler flue as shown, the method of supplying the air at the lower part of the room and taking it off at the ceiling being found the most effective for cooling purposes.

The elevator pump room is also supplied with cool air in a manner similar to the boiler room. The air is furnished by a centrifugal blower of the usual ventilating type placed upon an elevated platform at the rear of the boiler room and driven by a direct-connected motor. The air is drawn from an opening over one of the entrances to the building through a brick downtake.

Boilers

THREE Heine water-tube boilers of 153 rated hp. each are used for generating steam for power and heating purposes. These are set in a single battery, as shown in Fig. 2. Each boiler has 1533 sq. ft. of heating surface, with a grate area of 30 sq. ft. The shells are 36 in. in diameter by 19 ft. 4.5 in. in length of ⅜-in. plate, with dished heads ½ in. in thickness. The longitudinal seams are of the double-riveted butt-joint type with inside and outside covering strips; girth seams are single riveted.

Water legs are of flange steel plate, ½-in. thick and supported by means of hollow stay bolts. Each boiler contains 94 steel tubes, 3½ in. in diameter by 16 ft. in length. The boilers are designed to carry a working pressure of 180 lb. per square inch and were tested under a hydrostatic pressure of 270 lb. before leaving the shop.

Settings

THESE are of the general form shown in Figs. 2 and 4. The side wall next the engine room is 7 in. in thickness with a 3-in. air space. The outer wall and division walls are 19 and 20 in. thick, respectively. The setting is of Norton red brick lined with Ostrander's Mohawk brand fire brick. Red faced brick with ruled joints are used for the outside courses where exposed to view.

All fire-clay mortar was salted, and the joints rubbed to a close contact. Lime mortar used in the work was mixed 24 hr. before using. The 5 top courses of rear and cross walls are laid in Portland cement, consisting of 1 part cement to 3 of clean sharp sand. Other red brick are laid in lime mortar to which was added 12½ per cent of cement.

Boiler Trimmings

EACH boiler is provided with the following trimmings: 1 3½-in. Ashton pop safety valve, set at 125 lb.; 1 Reliance water column, with high and low alarm; 1 12-in. dial Ashton pressure gage reading to 200 lb.; 3 Phillips try cocks with lifting handles, and 1 Huyette quick-closing water gage and glass; 2 1½-in. Cadman blow-off cocks, backed by heavy gate valves; 2 1½-in. heavy gate valves and 1 1½-in. check valve for feed pipe. Copper funnels are provided under the try cocks, these being drained to ash pits. All trimmings are connected up with brass pipe and fittings, that portion which is exposed at the boiler fronts being polished.

Grates

THESE are of the shaking and dumping type, 60 in. wide by 72 in. long. The plant is provided with the Burke balanced draft system; air from a blast fan being introduced to the furnace through openings in the bridge wall.

Smoke Connections

THESE are shown in Figs. 2 and 4. They are constructed of No. 10 black iron stiffened with angle iron and supported from the ceiling by means of heavy strap-iron hangers. The main pipe is 42 in. in diameter, with 30-in. branches to each boiler. The main pipe is provided with a 45-degree damper mounted on anti-

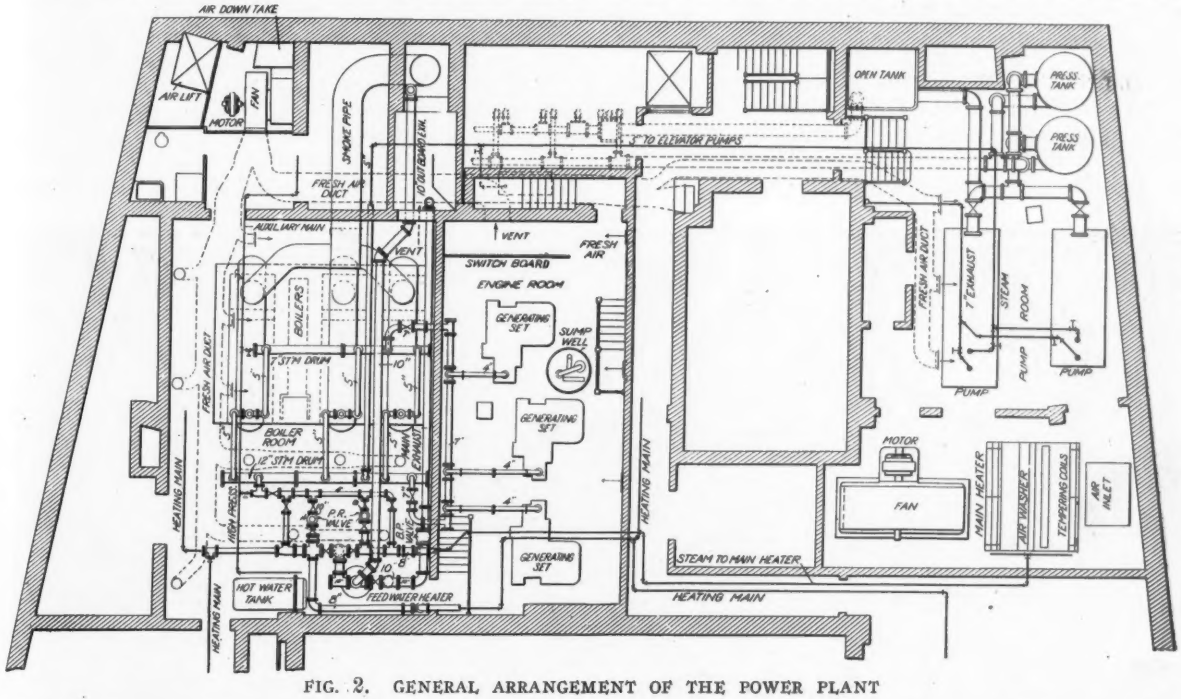


FIG. 2. GENERAL ARRANGEMENT OF THE POWER PLANT

friction roller bearings and connected to the automatic regulator by means of chains and pulleys. The branch to each boiler has an adjustable hand damper.

Extra Gages and Gage Board

IN addition to those at the boilers, several gages are mounted upon a marble slab in the engine room, these are of Ashton make with 10-in. dials, and are for indicating the following pressures: boiler pressure; low-pressure heating system; city water pressure; elevator tanks; also a recording gage for boiler pressure and a locomotive clock with 10-in. dial are mounted upon the same slab.

Blow-Off Tank

THIS is made with a ¼-in. wrought-iron shell, with cast-iron heads, and tested to a hydrostatic pressure of 150 lb. It is 36 in. in diameter by 84 in. in height and is mounted on the floor above the boiler room as shown in Fig. 4. It is provided with a 1½-in. inlet from the boilers near the top, a 4-in. over-flow connec-

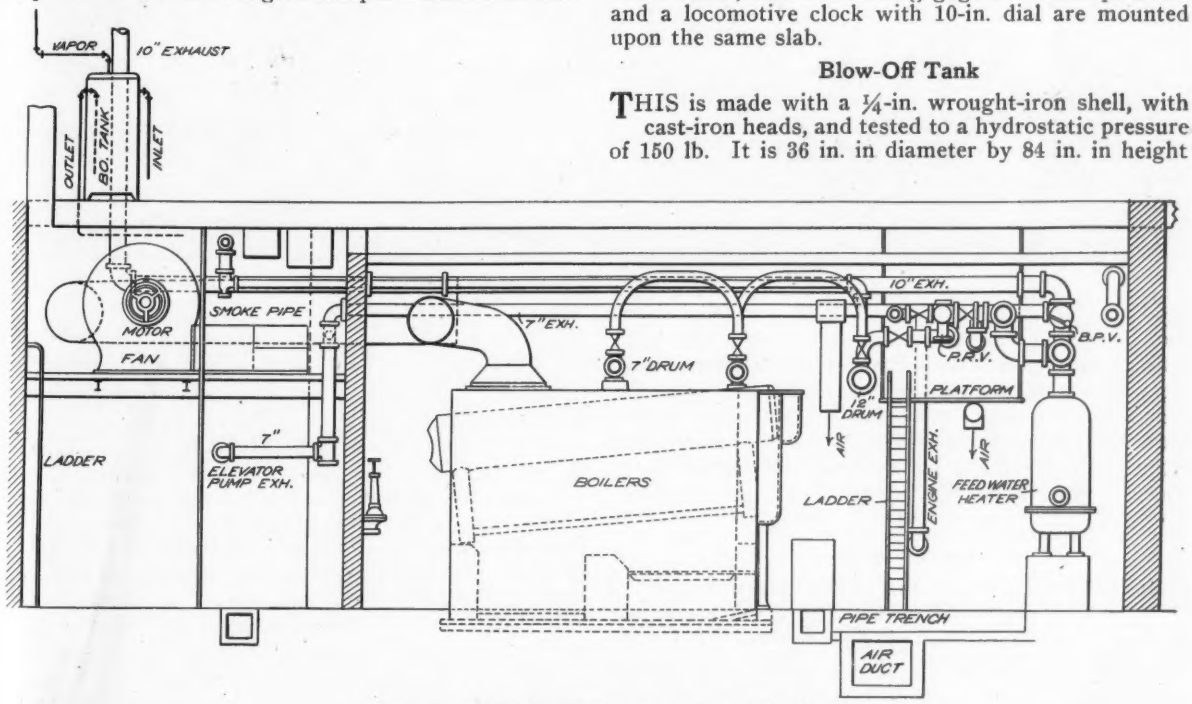


FIG. 4. SECTION THROUGH BOILER ROOM

tion taking water from near the bottom of the tank as shown, and a 4-in. vapor pipe from the top leading up the brick vent around the chimney stack to a point about 150 ft. above the boilers. This pipe also serves as a drain for the main exhaust head.

Return Tank

CONDENSATION from the heating system and the drips from the various high-pressure traps are received in the return tank, which is located in the boiler room above the feed pumps as shown in Fig. 5. This has a ⅜-in. wrought-iron shell with cast-iron heads and is mounted upon heavy forged brackets. One head is fitted with a manhole and cover, the latter embodying a float attachment for automatically governing the action of the pumps, according to the height of the water level in the tank. All outlets are reinforced and connections are made for the various returns, cold-water supply, vapor pipe, pump suction, and draw-off. The tank is also provided with a gage glass.

Feed Pumps

BOILER-FEED pumps are of the Warren make, 7½ by 5 by 6 in. in size. They are of the horizontal duplex, outside packed plunger type, brass fitted, with valves suitable for pumping hot water. The steam cylinders are covered with insulating material and lagged with Russian iron. The bases are fitted with cast-iron drip pans which are drained to the sump well. Each pump has a Barclay sight-feed lubricator, and a Fitts chronometer valve is placed in the main steam supply, which is operated by the float within the return tank already mentioned.

Automatic Sump Tank

THIS consists of a 36 by 60-in. cast-iron catch basin located in the engine room as shown in Figs. 2 and 6. It is piped for taking the drips from steam traps discharging oil, also the drainage from boilers, hot-water tank, return tank, feed-water heater, etc., which are below the level of the sewer. Connected with the catch basin is a Yeomans Bros. No. 2 bilge pump with a direct-connected 1½-hp. electric motor, which is operated automatically by means of a float switch and controller. This apparatus has a capacity of 50 to 75 gal. a minute under 25 ft. head. The pump discharges through a 2-in. connection into the overflow from the blow-off tank at the sub-basement ceiling.

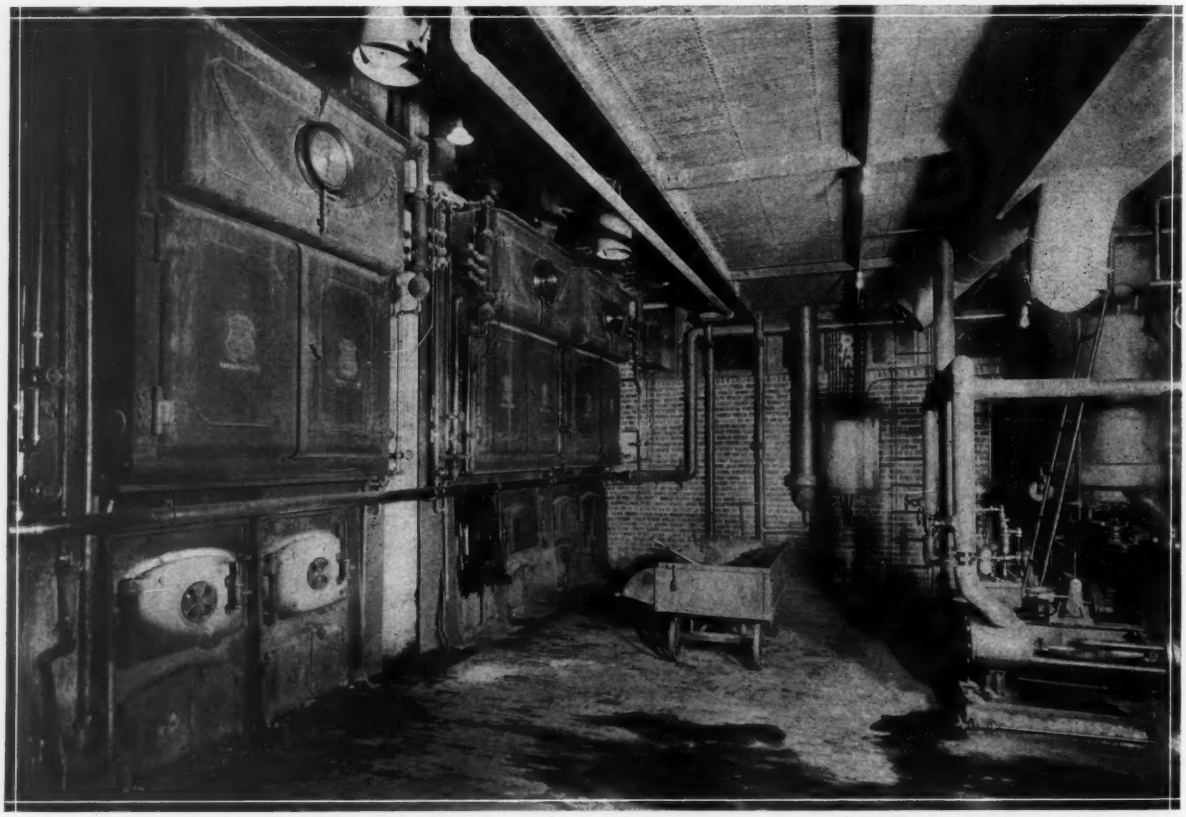


FIG. 3. BOILER ROOM OF THE BOSTON SAFE DEPOSIT AND TRUST CO. BUILDING

Feed-Water Heater

A 450 hp. Berryman feed-water heater is used, and is connected as shown in Figs. 4 and 5. It is of the water-tube type, having a shell 39 in. in diameter by 95 in. high and containing 300 linear feet of 2-in. brass tubing. The exhaust connections are 10 in. and the feed connections 3 in.

Feed Piping

ALL feed piping between return tank and pumps and boilers, including heater connections and bypass, are of brass, fitted with brass valves and unions. Brass is also used for connecting up the ejectors for draining the elevator and scale pits and also in connection with the hot-water boiler. All brass pipe is iron pipe size, semi-annealed.

Engines

ELECTRICITY for power and lighting is furnished by 3 generating sets of 50 kw. capacity each and located as shown in Figs. 2 and 5. The engines for driving the generators are of the simple horizontal automatic cut-off type, built by the American Engine Co. The cylinders are 13 in. in diameter by 11-in. stroke, and run at a normal speed of 275 r.p.m. Lubrication is effected by an automatic circulation of oil which supplies the crank shaft bearings, connecting rod boxes at both ends, and cross-head guides.

In the governor of the American-Ball engine are 2 arms; the additional one is so pivoted that its center of gravity is practically on the axis of the shaft and, therefore, develops no centrifugal force. This second arm is so connected to the governing or centrifugal arm that the gravity of one is always opposed by the gravity of the other at every position of the wheel, hence the centrifugal force of the governing arm under the control of the springs is made to govern the engine, while the disturbing gravitation of this arm is neutralized or balanced by the opposing gravity of the second arm which has practically no centrifugal force. The gravity oscillations of single arm governors are thus prevented by the use of this gravity balance.

The arrangement of the double springs has been found effective in preventing trouble caused by swaying of single springs due to centrifugal force and gravitation, which in many cases interferes seriously with the delicate balancing of the governing forces so necessary to good government. The arrangement of these springs and the gravity balance of the pivoted arms are both features that produce stability of action and freedom from irregularities of speed.

One of the distinctive features of the American-Ball engine is the valve, which consists of 2 parts, in reality 2 valves with telescopic sleeves connecting their backs and forming a continuous passage. The 2 faces of this double valve perform similar functions on opposite seats in the steam chest, the seats being duplicates of each other in regard to the ports.

Steam is admitted through the central opening on the top of the steam chest into the interior of the valve, which is in communication at all times with the boiler through this opening. The faces of the valves are held in contact with their corresponding seats by steam pressure, and the diameter of the telescopic sleeves therefore determines the pressure of contact. A diameter of sleeve is selected that insures positive contact between the valve and its seat in all positions without undue friction.

The crank shafts are made of hammered steel of low carbon, forged in 1 piece. The engines are provided with heavy cast-iron bases extending to the floor level. The guaranteed steam economy of the engines is as follows: Full load 30 lb. per i. hp. per hour, ¾ load 32 lb., ½ load 35 lb., ¼ load 40 lb. and 1¼ load 31 lb.

Generators

THESE are of the 3-wire direct-current, compound wound, vertically split, engine type rated at 50 kw. each, made by the Westinghouse Electric & Manufacturing Co. They run at a normal speed of 275 r.p.m. and generate current at 250 volts. Each machine is provided with rheostat, also balance coils and appurtenances designed for 25 per cent unbalanced load. The guaranteed efficiencies at normal speed and voltage are as follows: ¼ load 84 per cent, ½ load 89, ¾ load 90, full load 90 and 1¼ load 89.5 per cent.

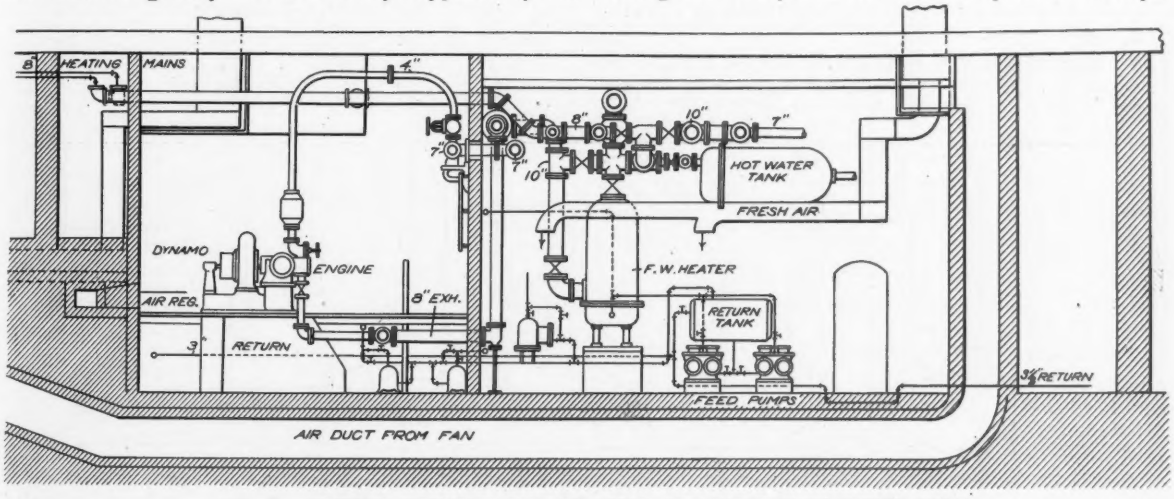


FIG. 5. SECTION THROUGH ENGINE ROOM AND PORTION OF BOILER ROOM

After the brushes are once adjusted, the machines are designed to run with practically no sparking between the limits of no load and 50 per cent over load, and to run at full load for 24 hr. without sparking or burning the brushes or blackening the commutator. The load may be increased temporarily to 75 per cent over load if the current in the shunt field be adjusted so that the voltage of the generator at no load is 230 volts.

The guarantee also states that after running continuously for 24 hr. at full load the temperature in no part of the generator will be more than 35 deg. C. above the surrounding air, when the temperature of the air is 25 deg. C., and that it will carry 50 per cent over load for the same period with a rise not exceeding 50 deg. C. It will carry momentarily an over load of 75 per cent without injurious heating.

The fields of the generators are compound wound and so proportioned as to increase the voltage by approximately equal increments from 230 volts at no load to 245 or 250 volts, as desired, at full load.

The shunt and field coils are separately insulated and the insulation between the coil windings and frame was subjected to a momentary test of 1500 volts.

Armatures are of the slotted drum type and have a 2-circuit winding so arranged that the circuits will not

become unbalanced with the armature displaced 1-32 in. from its geometric center. The insulation of coil windings and armature core were also subjected to a momentary puncture test of 1500 volts. The commutator bars are of hard drawn copper, and the number such that with an electromotive force of 250 volts on the generator the average difference of potential between 2 adjacent bars will not exceed 6 volts.

Elevators

ELEVATOR equipment consists of 5 plunger, and 3 electric passenger elevators and 1 plunger ash lift, all furnished and installed by the Otis Elevator Company.

Three of these plunger elevators run from the first to the ninth floor, a rise of about 112 ft., and are built to carry a load of 1500 lb. each at a speed of 400 ft. a minute; and a maximum net load of 2400 lb. at a somewhat slower speed.

A fourth elevator runs from the lowest landing to the ninth floor, a rise of about 150 ft. with the same ordinary duty as above, but has a jack pump connection which enables it to carry loads of 5000 lb. at slow speed.

The cylinders are made of steel pipe with cast-iron stuffing box. The plungers are of polished steel tubing, 6½ in. in diameter, the lower ends being of brass and provided with elastic bearing plates.

The cars are approximately 5 by 6 ft., with steel frames and wooden floors, and are controlled by a lever shipper device operating a pilot valve which governs the main valve, and arranged to bring the car to rest at the terminal landings by automatic stop valves.

The fifth elevator runs from the basement to the first floor, a total rise of 16½ ft. and is designed to carry a load of 1000 lb. at a speed of 100 ft. a minute, and a maximum load of 1500 lb. at a lower speed. The floor of this car is 4 by 5 ft. in size and the plunger and cylinder are similar to the others just described, except in length. The ash lift has a rise of about 40 ft. from the boiler room floor to the sidewalk. The floor of the car is 3½ by 5 ft. and covered with iron plate. It is capable of carrying a net load of 1000 lb.

Pumping Plant

THIS is capable of furnishing water at a pressure of 150 lb. a square inch, and consists of the following apparatus:

Two pressure tanks of 6400 gal. total capacity and 1 discharge tank of 5600 gal.; all being made of steel. The pressure tanks are provided with gages showing height and pressure of the water and the discharge tank is furnished with over-flow and draw-off pipes connected with the sewer.

Three Deane pumps furnish power for operating the elevators. One of these is a compound duplex, 20 and 30 by 16 by 18 in., and one a simple duplex, 24 by 16 by 18 in. Each pump has sufficient capacity to allow the 4 main elevators to make 1 round trip every 1½ min. when supplied with steam at 100 lb. pressure.

The jack pump is 7½ by 4½ by 6 in. in size, of simple duplex type. Compressed air for the pressure tanks is supplied by a Westinghouse steam compressor.

Electric Elevators

THREE electric passenger elevators are provided as follows: One 4½ by 5 ft. in size, running from the basement to first floor, 1 4 ft. by 4 ft. 3 in., running from first to mezzanine floor, and 1 4 ft. 7 in. by 4 ft. 8 in., running from basement to mezzanine floor.

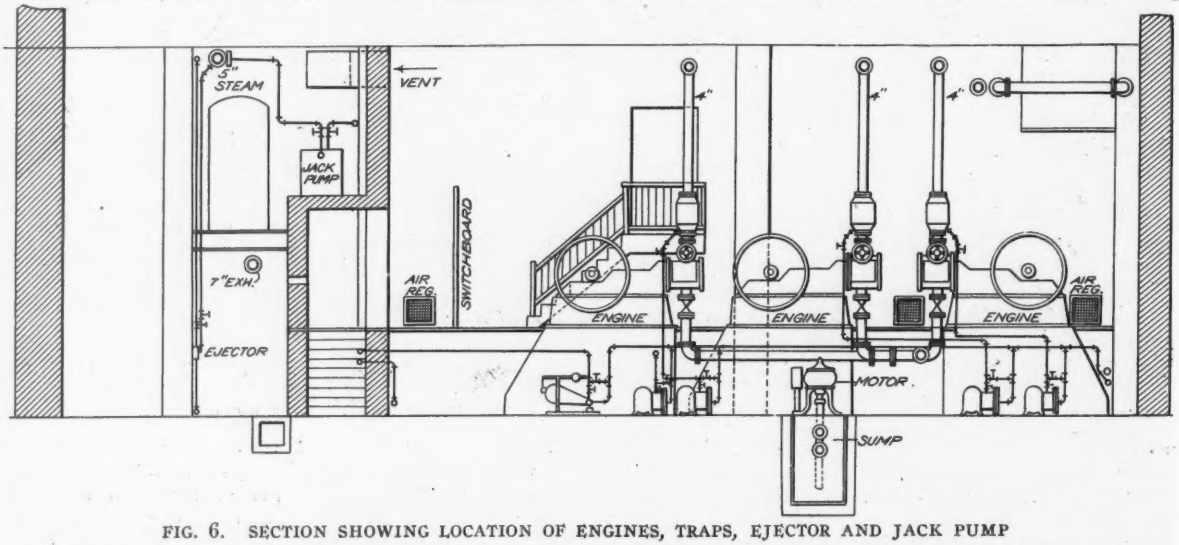


FIG. 6. SECTION SHOWING LOCATION OF ENGINES, TRAPS, EJECTOR AND JACK PUMP

Each elevator is capable of lifting a net load of 1250 lb., and will carry a load of 1100 lb. at a speed of 100 ft. a minute with a constant pressure at the motor of 220 volts. The cars are each provided with 2 lifting cables, ⅝ in. in diameter, each having an ultimate strength of 10,000 lb., and 2 counterweight cables of the same size and strength.

The driving engines are of the worm and gear type, the worm being cut from a solid steel forging and integral with the shaft. The worm and gear are enclosed in an oil tight housing and run in oil. The winding drums are of cast iron grooved to receive the cables.

The elevators are operated from the cars by means of a series of push buttons, numbered to correspond with the various landings, the pressing of one sending the car to the designated floor. In addition to these buttons, there is placed in each car a safety button which will stop it at any point of its travel.

Steam Drums

TWO steam drums are used, both being connected with each boiler by 5 in. leads. The larger drum is of cast iron, 12 in. in diameter and occupies a position just in front of the boilers. It has a 7-in. connec-

tion with the engines, a 5-in. connection with the elevator pumps, and a 6-in. nozzle for the heating system and auxiliary high-pressure main. It is provided with 2 1-in. drips, one at each end, for drainage. It is made in 2 sections bolted together by means of heavy flanges.

The smaller drum is also of cast iron, 7 in. in diameter, and occupies a position across the boilers at the rear of the nozzles. It is connected with each boiler and has a 7-in. connection with the engines and a 3-in. connection with the auxiliary high-pressure main.

High Pressure Piping

ALL steam piping subject to boiler pressure is "full weight" wrought iron; all fittings between boilers and the main drums, and in mains running to the engines and elevator pumps are extra heavy, long turn pattern, with flanges faced and drilled to the "manufacturers' standard." The flanges for ends of straight pipe, offsets and bends, 4-in. and above, are of the Van Stone type. Piping 3½-in. to 2½-in. inclusive, have extra heavy flanges made on to the end of the pipe, first by threading and then by peening into a recess in the flange and facing off in a lathe. All other high-pressure piping is made up with standard wrought-iron pipe and extra heavy screwed fittings, with brass unions or union flanges provided in all connections. All flanged joints have corrugated copper gaskets and are made up with a preparation of graphite and boiled oil. All piping is supported and held in position by beam clamps and adjustable forged wrought-iron hangers, by hooks and rings, eye-hooks and expansion bolts, pipe rolls and hangers, rolls and chairs, or wall brackets and adjustable rolls, as best suits the location and conditions.

The main steam drum is supported with beam clamps, wrought-iron adjustable hangers and pipe rolls, while the smaller drum rests on pipe chairs and rolls bolted to piers extending from the boiler setting.

The 7-in. main in the engine room is supported from the wall by Walworth's universal cast-iron brackets, with adjustable rolls, wall bolts and plates. The exhaust main under the engine room floor rests on pipe chairs and rolls supported by brick piers. The vertical portion of the exhaust pipe is carried up in the corner of the brick flue beside the smoke stack and is supported by I-beams and clamps at the base and is held in position by wrought-iron clamps fitting loosely around the pipe with the ends bricked into the wall of the chimney.

The pump and engine mains are anchored where necessary by means of wrought-iron clamps attached to the fittings and secured to the brick walls with heavy rods provided with turn buckles for adjustment. The general arrangement of the piping is as follows:

Starting at the boiler nozzles, 5-in. leads are carried to both the 7 and 12-in. drums, these connections are made up of a pipe bend and 2 valves as shown in Fig. 2. From the smaller drum a 7-in. steam main is carried into the engine room and along the boiler room wall, having a cross-connection at the end with the 12-in. drum as shown. From this 7-in. main, 4-in. connections are made with the 3 engines by means of pipe bends with valves, as best shown in Fig. 5. A 5-in. main is carried from the 12-in. drum to the pump room, where a 4-in. connection is made with each of the 2 elevator pumps, a 1½-in. connection to a jack pump, a 1¼-in. connection to an air compressor for elevator service, and a ½-in. connection to the ejector for elevator pit.

From an outlet on each drum a 3-in. connection is made with the auxiliary main from which branches are carried to the feed pumps, 2 ejectors, 3 air compressors, hot-water tank, draft regulator, soot blower, and coils around the skylight for melting snow. A 6-in. connection is taken from the main drum for supplying the heating system through 2 pressure reducing valves; a 5 by 10-in. valve supplying the direct radiation, and a 4 by 8-in. valve the main heaters at the ventilating fan. Each of these valves is provided with a full sized by-pass, with gate valve.

The engines are each provided with a 4-in. vertical Cochrane steam separator as shown in Figs. 4 and 6. These are furnished with water gages and are dripped to the receiving tank through high-pressure traps.

Exhaust Piping

ALL exhaust piping is of standard weight wrought iron with standard cast-iron fittings. Sizes 4-in. and above, except the main vertical outboard exhaust, are made up with flanged fittings faced and drilled.

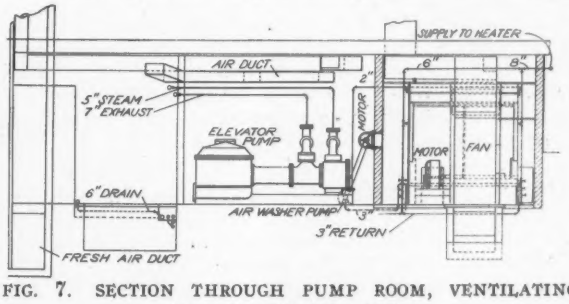


FIG. 7. SECTION THROUGH PUMP ROOM, VENTILATING FAN AND HEATING ROOM

Smaller sizes are made up with screwed fittings. The exhaust pipes from the engines, elevator pumps, and air compressors are connected into a 10-in. main at the boiler room ceiling, which runs to a Peerless grease extractor, thence to the feed-water heater, with a full sized by-pass around it, thence to the vertical outboard exhaust, which is carried to the top of the chimney, a distance of about 165 ft. The outboard branch is fitted with a G. M. Davis Co.'s 10-in. flanged back-pressure valve at the point shown on plans. A second 10-in. branch is carried to the heating main for direct radiation, an 8-in. branch is connected with the supply to the main heaters at the ventilating fan, and a 3-in. branch is carried to the hot-water boiler. The exhaust from the boiler-feed pumps, air compressors for the sewerage system and temperature control system are carried in an independent pipe which is connected into the main exhaust beyond the back-pressure valve.

The vertical section of the outboard exhaust is put together with couplings and has a heavy base elbow at the bottom. This pipe terminates with a 10-in. Swartwout exhaust head which is drained through a 2½-in. drip pipe into the vapor pipe from the blow-off tank.

Valves

ALL high-pressure valves 2½ in. in size and larger have outside screw and yoke, iron bodies and extra heavy flanges drilled to "manufacturers' standard." Smaller valves are of brass with screwed connections. Sprocket wheels and chains are provided for operating the 3 valves in the engine connections. Gate valves are used in all exhaust piping; those 2½ in. and above in size are flanged, have iron bodies with inside screw

and bronze seat. Smaller valves are of brass with screwed connections.

Pipe Covering and Insulation

ALL high-pressure steam piping, exhaust, vapor, and drip piping (except brass drips), and all boiler-feed piping from the pumps and feed-water heater to the boiler settings are covered with 85 per cent magnesia sectional covering of standard thickness, finished with regular canvas jacket and secured in place by lacquered metal bands. All fittings, valves, and flanges on these lines are covered either with moulded covers or with plastic magnesia finished with canvas. The covers on flanges in high-pressure steam lines are made up over wire netting frame work so as to be easily removable in 2 sections.

The ends of the boiler drums are covered with 2 in. of plastic magnesia. Smoke connections are protected with the same material of the same thickness.

Feed-water heater, return and hot-water tanks are covered with plastic magnesia 1½ in. thick. All exposed covering in the boiler room, engine and pump rooms has an extra 8-ounce canvas jacket sewed on over rosin-sized sheathing paper.

The architects for the building were Shepley, Rutan and Coolidge; the designing and constructing of the steam plant, including heating and ventilating, was done by Buerkel & Co.; the electrical work, including engines and generators, was laid out and installed by E. C. Lewis, all of Boston.

WHEN BABBITT CAME IN HANDY

SAY, Billy, you'd think those Ginnys on the cranes would learn what a grease cup's for, but that "experienced operator" we'd put on the "hot metal" crane 'cause he's so careful turned in a report that the main hoist chain was slipping over the top sheave. 'Course I was the investigating committee and the correctness of that report was easy to see and when we got that crane down to the end of the runway I saw a puzzle ahead, for the hole in the sheave was a good 2 in. bigger than the pin and it wasn't round either.

Then the hubs were not as long as they had been and jagged ends showed a part of 'em were gone. Well, what the hotel I was to do was my next guess. No spare sheave in the shack and that crane just simply had to be kept running. Couldn't hang her up for more than 4 hr. at a time, 'cept there'd be somethin' doin' in the line of jacking up yours truly. Well I got to looking wiser nor an owl, but sayin' nothin'. Just a sparrin' for time. The next cast was due in an hour and I hustled Joe up to the furnace to get them to hold back the one after that. Then I found the diameter of the sheave pin was 5 in. and that the space took up by the hubs was 10 in. long with the groove central, seein' the other top sheave was O. K., this was easy. The outside diameter of them hubs was about 9 in. and with this I moseyed up to the machine shop, still a-thinkin'.

I met Joe there and found I could have the scrap pile for 6 hr. after the cast, an' my eye lit on some nice 5 in. cold rolled stuff, none of that 32nd shy stuff for mine. Lucky, the foreman, was a pal o' mine an' proper sympathetic, but he'd not stand to have any of that shaft spoiled, and while 2 ft.'d been enuff I had to take ten. Then I got Jimmie to bore and face a couple of collars, 'bout 9½ in. outside, while we got out some tackle to get that shaft down. We let out the chain 'till we could get horses under the hook block, then we eased the chain off the sheaves and got a hitch on the busted one, bunted the pin out'er her and lowered away.

Well, we got that wheel up to the shop and drilled a few holes in the hubs, cleaned off the grease and got her centered on the shaft on the bench, with enough blocking to hold her. The 2 collars were then set to make the ends of the hubs, some paper was wound on to form the outside of the hubs and fastened with soft copper wire. Clay gates were built and the mould, well doped up, was all ready to pour. We had a ladle full of "genooine" all melted, and then there was the dumpin' of it in and ripping the mould off. Well, we had a sheave there and it didn't take long to true up the rim and get her hoisted back on the crane, plenty of time to spare before the next cast.

Well, the next thing up to little Harry was to prepare for the worst, I'd made a sketch of the sheave and had a pattern made, didn't like cast iron so got a steel casting. I put a bronze brush in her half an inch thick, press fit. I made up my mind the grease'd get a good chance this time so I fixed her up with a nice spiral oil groove an eighth deep and an eighth wide one inch pitch running to a half inch of either end. I eased off the sides of the groove so the grease could spread. Of course, now I got some spares those blamed sheaves will never wear out.

METAL PACKING

By J. F. Boreland

WHEN I talk to engineers about metal packing I find there is an old tradition holding on to them. Tradition is alright in its way—but it don't weigh much. The fellow that knows a good thing when he sees it is the one who has charge of the large power plants.

It seems that a great many engineers have peculiar ideas about the use of cast-iron packing rings for piston rod and valve stem packing. The principal objection is that cast-iron rings are too hard. Evidently this objection results from the idea that the harder the metal the greater the friction; consequently the greater the wear on the rod. This is far from the truth—from actual facts—as friction is practically independent of hardness of metal. I quote from the highest authority in the engineering world on such subjects—Kent—"Friction is greatest with soft and least with hard materials."

An engineer recently stated "In the case of an engine in which the piston rod was disconnected from the crosshead and when the gland was screwed up no tighter than usual, the friction developed required a weight of 653 lb. to act upon the piston before the piston rod would move through the gland."

I recently removed a metal packing from a piston rod on which it had been running for 12 yr. and I found that the rod had worn only 0.005 in. in the time.

In a purely metal packing—the kind that consists of rings fitted in the grooves of a case, the rings being held together by springs—there is hardly any friction or wear on the rod as the rings—which are the packing—are free to move laterally with the rod.

Steam engines of today are run at high speeds and high pressures and a good metal packing will give lasting and satisfactory service required under these conditions. Engineers are becoming more appreciative of this class of packing for steam, air, gas and ammonia.

MODERN CENTRIFUGAL PUMPS

CONSTRUCTION AND CHARACTERISTICS

By Geo. H. Gibson

WHILE centrifugal pumps have been on the market in this country for over 50 yr., so that engineers are generally familiar with them, conclusions drawn from experience with the ordinary centrifugal pump should not be applied to the modern pump of scientific design and manufacture.

In the improved multistage pump, as shown in Fig. 1, there are 4 stages, but all the individual parts and passages are at once accessible upon breaking one joint in the casing and lifting the pump case cover. After removing the bearing caps, all moving and wearing parts may be taken out and replaced in a short time. It is not necessary to break either the suction or discharge connections, both of which are in the lower part of the pump casing.

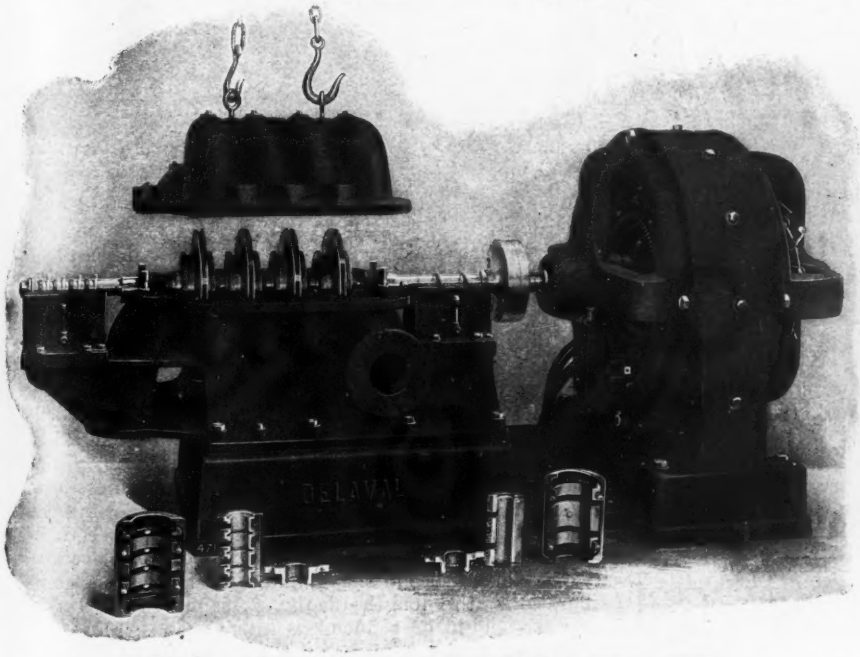


FIG. 1. A 4-STAGE DE LAVAL CENTRIFUGAL PUMP, SHOWING SIMPLICITY AND ACCESSIBILITY

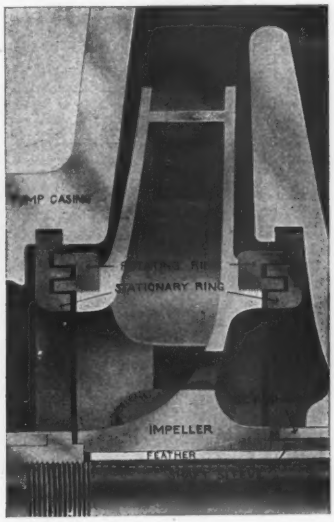


FIG. 2. SECTION OF PART OF IMPELLER AND CASING SHOWING WEARING RINGS AND BUSHINGS

Important in the design and manufacture of centrifugal pumps is interchangeability, although this point is apt to be overlooked by the purchaser. That is, a pump should not only be well designed to do its work, but it should also be so built to gages and templets that all parts are strictly interchangeable and can be replaced by similar parts from the factory without fitting. This can be secured only by a modern system of manufacture to limit gages.

Further, it should be possible for an ordinary mechanic to take out and replace parts subject to wear without disturbing piping connections and without putting the pump out of service for a long period of time. To this end it is desirable that the bearings be made detachable from the pedestals and that split shells ground to gage and fitting in ground sockets in the pedestals be used, as illustrated in Fig. 1.

One of the chief points where wear is likely to take place is at the running joint between the impeller and the casing. Both casing and impeller should be provided with removable wearing rings, as illustrated in Fig. 2. The stationary rings in the pump here illustrated are held in the casing and can be at once lifted out when the cover has been removed. The moving rings are attached to the impeller. Both rings, as well as the impeller itself, are of bronze.

Another joint where the shaft passes from one stage to the next, is also subject to wear from leakage. As will be noted, this also is protected by a bushing, while the shaft itself is protected by a sleeve where it is not protected by the impellers. The use of a sleeve on the shaft wherever it would otherwise come in contact with the liquid is important, especially where the shaft passes through the packings in entering and leaving the casing, since it is subject to wear at these points not only by water, but by grit which the water may force into the packing. If the shaft is not protected, this results in rapid cutting, so that renewal of the shaft soon becomes necessary, whereas if it is covered by a bronze sleeve the latter only need be replaced.

From a practical point of view it is in the use of the split casing, renewable wearing rings, sleeves for the shaft, bearings removed and apart from the casing so that they are not affected by water, and similar points that the new and improved centrifugal pump offers advantages, as well as one further feature, which is efficiency.

Wearing of the joints by foreign matter has been overcome by the use of the labyrinth type of wearing ring shown in Figs. 2 and 3. Here, as will be seen, the leakage water must pass through a tortuous channel, making 6 right angle turns in so doing. At each turn

the head due to the velocity of the water is destroyed, so that with equal clearance such a joint will leak much less than would an ordinary flat joint. Further, the water in the labyrinth passage is set in rotation by the motion of the rotating ring, which creates a centrifugal force counteracting to a certain extent the tendency to leakage.

By reducing leakage this improved joint makes possible the building of pumps with much higher pressures per stage than were heretofore considered feasible. The statement is frequently made that centrifugal pumps are not adapted to heads of over 100 or 125 ft. per stage. Nevertheless single-stage pumps fitted with these improved labyrinth rings are being built for boiler-feeding for pressures upward of 200 lb. per sq. in., that is, about 460 ft. head. Reducing the number of stages of course lessens the number of parts and the complexity of the pump.

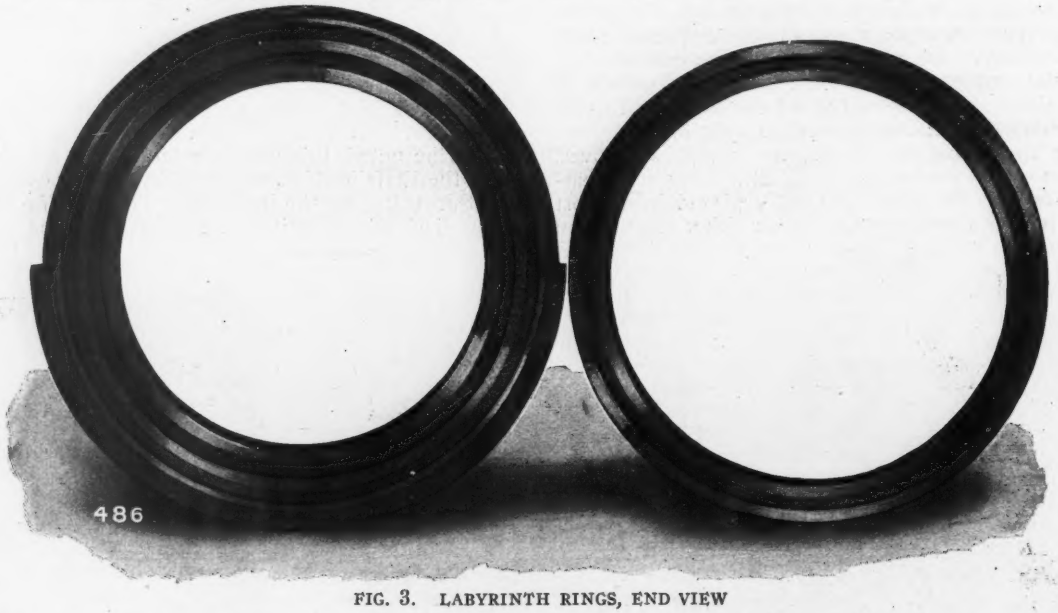


FIG. 3. LABYRINTH RINGS, END VIEW

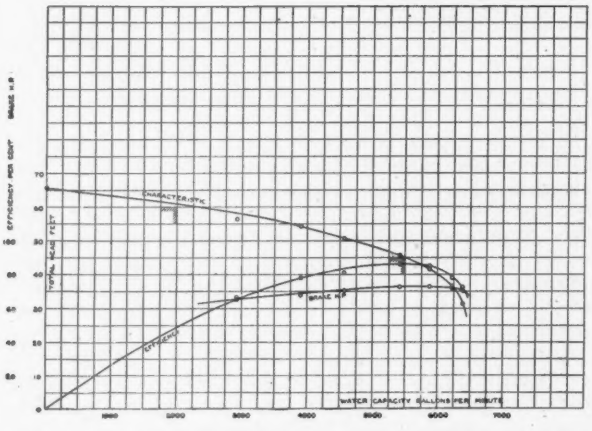


FIG. 4. CHARACTERISTICS OF A DE LAVAL 16-IN. SINGLE-STAGE PUMP

A second factor which has had great influence in improving the efficiency of the centrifugal pump is the use of impellers of smaller diameter. Losses of energy due to the impeller may be considered under 2 heads: losses occurring within the impeller, depending on the manner in which the stream of water through the passages is handled; and those occurring without the impeller, and due to the fact that the impeller rubs against the water in which it revolves.

To begin with, the impeller should receive the water without shock. This is important, not only from the standpoint of efficiency, but also from that of satisfactory running.

Once within the impeller, the water should flow through it without shock or undue skin friction. Shock is due to improper shape of passages, which may also give rise to cavitation and subsequent corrosion. Skin friction is determined principally by the roughness and extent of the passages. It is, therefore, important to have the impeller of such form that the interior can be finished, and to make it of a material that will retain its original finish and shape, and aside from other considerations, the length of the passages through the impeller should be reduced as much as possible.

Energy losses occurring on the outside of the impeller are similar to those encountered when a ship is forced through the water. They are traceable both to viscosity and to eddies, and their amount, besides depending upon the nature of the surface, increases about as the square of the velocity at which the surface travels through the water. Now, to generate a given head the periphery of the impeller of a centrifugal pump of any type whatsoever, must, within fairly close limits, run at a certain definite velocity. Then, if we consider a square inch of outside surface on the impeller, it will be seen that it will meet a certain resistance as it revolves, which, multiplied by its velocity, will represent the rate at which it is wasting energy. Therefore, of 2 pumps generating a given head, the larger diameter impeller will have a greater number of square inches of surface moving at any given velocity, and will, therefore, waste a correspondingly greater amount of energy. In addition to this, the width of surface between 2 given velocity limits will be greater as the diameter of the impeller is greater, so that the extent of surface running through the water at a given velocity will increase as the square of the diameter. In other words, the external impeller friction in pumps

generating a given head varies as the square of the diameter, so that the small diameter impeller has much the better of the argument.

With the inclosed impeller, the retaining strouds revolve with the water, thus cutting down friction and eddy currents; also as there is no leakage, the clearance can be made larger, giving mechanical safety.

graphical charts. Take for instance, Fig. 4, showing the characteristics of a De Laval 16-in. single-stage pump designed to deliver 5500 gal. a min. against 45 ft. head, or 2000 gal. a minute against 60 ft. head.

This pump is intended for use in connection with a barometric condenser and is required to deliver at the higher head in order that it may be able to start the

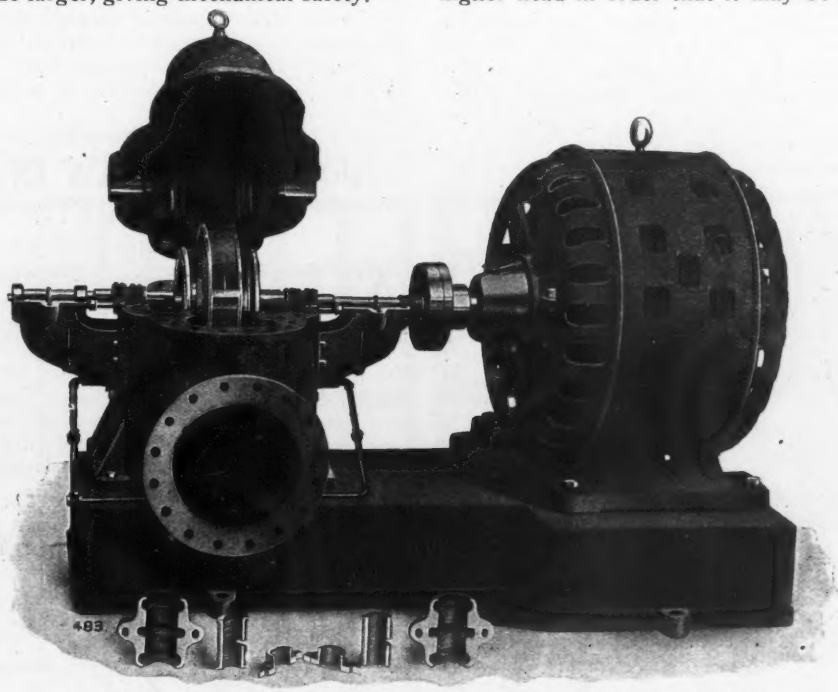


FIG. 5. SINGLE-STAGE MOTOR-DRIVEN PUMP WITH PUMP COVER LIFTED

As to diffusion vanes, while they are of some value, if properly designed for the speed of the pump, any change in speed much reduces their effectiveness; the mechanical disadvantages have been found to offset the benefits so that their use in pumps with inclosed impellers is of doubtful value and rare.

flow of water to the top of the condenser without the assistance of the vacuum produced by the air pump. When the flow has been started the pump must then deliver the larger quantity of water required by the

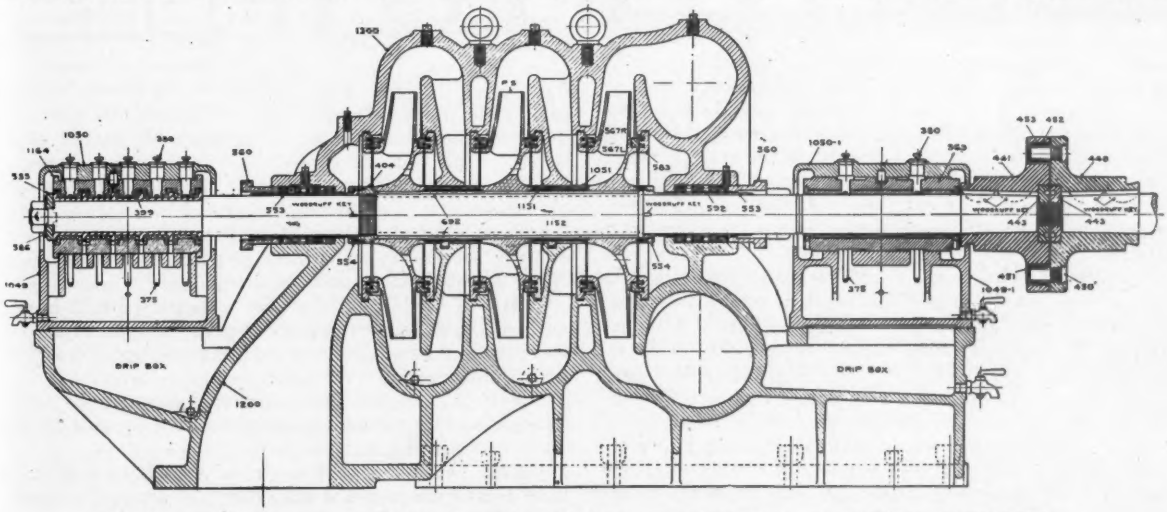


FIG. 6. CROSS SECTION OF 3-STAGE PUMP SHOWING ARRANGEMENT OF BEARINGS, IMPELLERS, PACKING RINGS AND TRANSFER PASSAGES BETWEEN STAGES

While speaking of efficiency, attention should be drawn to the methods of representing this and the other characteristics of centrifugal pumps by means of condenser at the lower head. The pump should operate with good efficiency throughout the range between these 2 points and with high efficiency at the larger delivery, which will be the condition under which it will operate during most of the time.

As will be seen from the chart, the pump generates a head of about 66 ft. when the discharge is entirely shut off. Upon opening the valve, the delivery increases with a decreasing head until the pump delivers 2000 gal. of water a minute against approximately 62 ft. With a still larger flow, the head generated gradually falls until at 5500 gal. a minute, the head generated is exactly 45 ft., while the efficiency has reached a maximum of 86 per cent. If the head on the pump be still further diminished, as might happen in the present case by rise of water in the suction well or sump, the flow will increase only slightly while the horsepower taken by the pump will actually fall off.

This matter of horsepower should be noted, especially as it is another respect wherein the modern improved centrifugal pump has an advantage. With many pumps, it will be found that the horsepower required increases steadily with increase of flow and decrease of head. That is, such a pump takes the most power when it is creating no useful head at all. This means that if the discharge head on such a pump were suddenly reduced, as by the bursting of the discharge main or the opening of a valve, the horsepower required by the pumps would increase, possibly to such an extent as to overload and burn out the driving motor. To avoid this, such pumps are usually equipped with a motor having a maximum capacity considerably in excess of the normal demands of the pump, which means a larger and more expensive motor and also that the motor will be running underloaded and consequently at lower efficiency under normal working conditions.

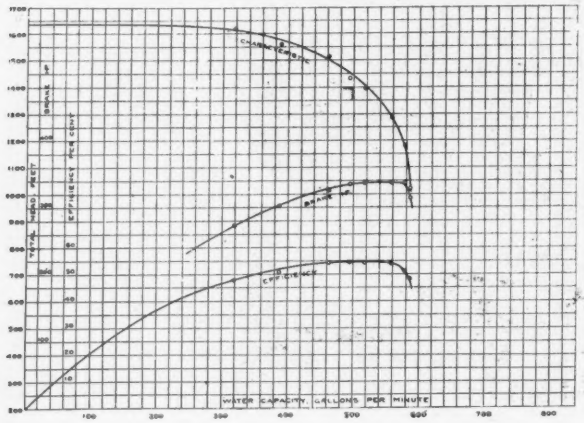


FIG. 7. CHARACTERISTICS OF 5-STAGE PUMP

A pump having somewhat the same characteristics as the one just described, but with a much more rapidly falling head-delivery characteristic curve is shown in Fig. 5. Such a pump would be very suitable for pumping out dry docks. At the beginning the pump would be able to deliver a very large volume of water, 13,000 gal. a minute, or so, against a head of 15 or 20 ft. Then as the water gradually would fall in the dock the delivery of the pump would slowly decrease, but the head generated would increase, while the power taken by the pump and the efficiency would remain fairly constant.

In Fig. 6 is shown the arrangement of thrust bearing used to keep the multistage impellers and labyrinth rings properly spaced. Transfer passages between stages are made a part of the casing, the flow being always from the suction end toward the discharge chamber. The characteristic of such a pump with 5 stages instead of 3 are shown by the curves Fig. 7. This was designed to deliver 500 gal. a min. against 1400 ft. head at a speed of 3000 r.p.m., driven by a 350-hp. turbine. It is for steel mill service and shows the same features in the multistage that Fig. 4 does for the single stage, but with higher efficiency spite of the added complexity.

For the drawings and photographs accompanying this article, also for much of the information, we are indebted to the De Laval Steam Turbine Co., of Trenton, N. J., which builds the line of pumps shown in the illustrations.

NEW SMOKE LAW IN MASSACHUSETTS

By Walter B. Snow

AS THE result of study and agitation by the Boston Chamber of Commerce, Massachusetts has a smoke prevention law, which went into effect July 1, that is notable for its scientific spirit, and for the precision with which it defines allowable and prohibited degrees of smoke emission. Two features in the new law are believed to be original and not to be found in previous antismoke legislation either in this country or in Europe. These features are the classification of stacks by inside diameter at the top, and the grading of smoke density by the Ringelmann smoke chart. Previous antismoke laws and ordinances have failed partly from lack of enforcement, but even more because what constitutes the "dark" or "dense gray" smoke usually prohibited, has been little more than a matter of individual opinion—there has been no standard on which all parties could agree.

TABLE OF SMOKE DENSITY BY RINGELMANN CHART, ALLOWED FROM VARIOUS CLASSES OF STACKS IN MASSACHUSETTS, DURATION OF EMISSION AND YEARLY CHANGE OF LIMIT

CLASS	1		2		3		4		5		6		LOCOMOTIVES MOVING TRAINS OF SIX CARS OR MORE	
	CHART NO.	MINS.	CHART NO.	MINS.	CHART NO.	MINS.	CHART NO.	MINS.	CHART NO.	MINS.	CHART NO.	NO. SECONDS IN 5-MINUTE PERIODS	CHART NO.	NO. SECONDS IN 5-MINUTE PERIODS
1910	3	6	4	5	4	10	4	9	4	12	3	40	3	50
1911	3	4	3	10	3	20	3	12	3	15	3	30	3	40
					INCLUDING 4	5								
1912	2	8	3	6	2	30	3	7	3	9	3	20	3	30
					INCLUDING 3	10								
1913	2	6	3	3	2	25	3	3	3	5	3	20	3	30
					INCLUDING 3	5								

Stacks are divided by the new law into the following six classes:

Class I includes all fixed or stationary stacks having an inside area at the top not exceeding the area of a circle 5 ft. in diameter.

Class II includes all fixed or stationary stacks having an inside area at the top greater than the area of a circle 5 ft. in diameter, but not exceeding the area of a circle 10 ft. in diameter.

Class III includes all fixed or stationary stacks having an inside area at the top greater than the area of a circle 10 ft. in diameter.

Class IV includes all stacks of vessels having an inside area at the top not exceeding the area of a circle 4 ft. in diameter.

Class V includes all stacks of vessels having an inside area at the top greater than the area of a circle 4 ft. in diameter.

Class VI includes all stacks on steam locomotives.

Section 2 of the law defines the densities of smoke, and the duration of time thereof, which are permitted to stacks of the several classes, but in order that the law

may not work too severely at the outset, the requirements are made progressive over a period of 4 yr., becoming more strict until in 1913 the most stringent requirements are in full effect. The table summarizes the requirements.

Enforcement of the law is put in the hands of the State Board of Gas and Electric Light Commissioners, who are required to appoint a chief smoke inspector and such deputies as may be needed for carrying out the provisions of the statute. It is specifically provided that the smoke inspector shall not engage in any other business.

He has not yet been selected, for the reason that the board is fully alive to the great importance of securing a man who is not only competent on the engineering side, but is also possessed of the tact, broad-mindedness and good judgment that will be needed for the successful working of the law. The board itself is given power after notice and hearing to order the cessation of prohibited densities of smoke from stacks, and in case of violation of such an order, to apply to the courts for the punishment of the offending party. The fine for a first violation of the smoke law is from $10 to $50, and for second and succeeding violations, $20 to $100.

The actual working out of the statute in Boston and the several neighboring cities to which it applies is of much more than local interest. The waste of fuel in smoke and the damage caused by smoke have been greatly exaggerated by inexact agitators, but it remains true that smoke is one of the chief causes of the dust loading of city air which causes so much harm to the lungs of city dwellers. It will not be the purpose of the board to stop all smoke, for this is recognized as an impossibility. Everything possible will be done, however, to lessen the amount of smoke poured into the city air. The board intends to act in co-operation so far as may be with power producers, for the betterment of general city conditions, and incidentally to the benefit of the power producer himself.

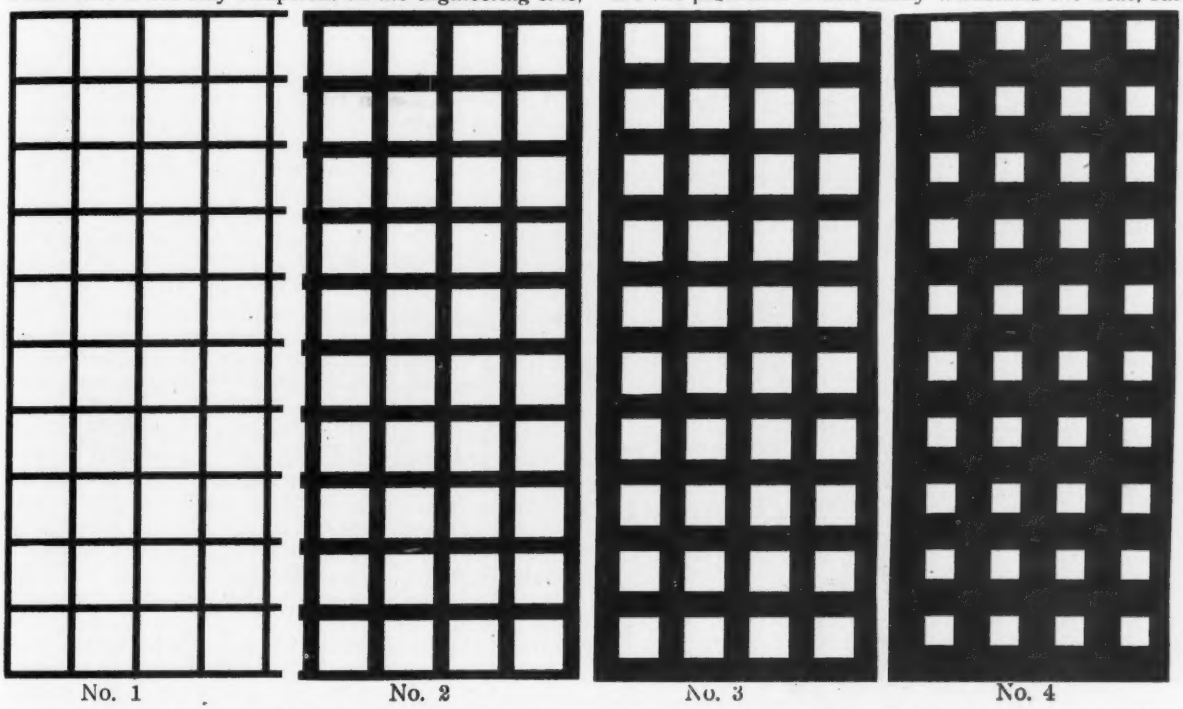


FIG. 1. SECTIONS FROM THE RINGELMANN SMOKE CHART. TO BE HELD AT ABOUT 50 FT. FROM THE OBSERVER AND THE DENSITY OF SMOKE COMPARED WITH THE CHART AND THE NUMBER TO WHICH IT COMES CLOSEST RECORDED

PAINTING THE SMOKESTACK

INTELLIGENT selection of paint demands 2 things: a knowledge of the paint's constituents (pigment and vehicle) and its record. When this knowledge is at hand it is usually easy to know whether a particular paint will meet the requirements of a specified service.

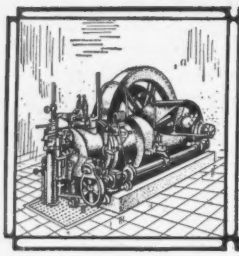
The service demanded from smokestack paint is in some respects very severe. The 2 most destructive elements usually encountered are the excessive heat and the sulphurous gases that escape from the stack.

Of all the paint vehicles, linseed oil is recognized as the best and most satisfactory. Silica and graphite are the pigments which easily withstand the heat, sulphurous gases, and atmospheric conditions. They are inert and therefore do not combine chemically with the oil, like many metallic pigments. Chemical combination of pigment and vehicle results in a brittle coating.

Due to the lubricating qualities of graphite, it spreads easily and evenly while the silica supplies just enough "drag" to prevent too thin a coat.

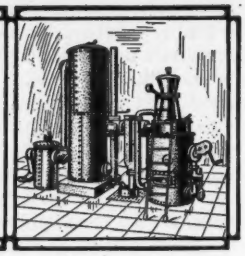
The big item in any painting job is the labor, which costs about the same regardless of the quality of the paint and its protective efficiency. In the case of stack painting the cost is increased because of the hazard, since painters are in danger of serious burns or fatal falls.

A point to be remembered is that the lasting results secured with Dixon's Silica-Graphite Paint are due chiefly to the pigment, silica-graphite. This pigment comes in natural combination direct from the Dixon mines located at Ticonderoga, N. Y., and therefore is always under the control of this company. Neither graphite nor silica alone provide so good a pigment as do both combined—the silica supplies the same need in the pigment that an alloy does in gold.—Graphite.



Gas Power Apparatus

Producers, Engines and Industrial Applications



LONDON LETTER

MULTICYLINDER VERTICAL GAS ENGINES

By W. A. Tookey

SPEAKING in a general sense, the development of the vertical gas engine in England has been somewhat neglected. The writer well remembers the great interest that was taken in the first Westinghouse gas engine of this type to be exhibited in England but, although this was many years ago, the number of British makers who afterwards took up the building of vertical engines could be counted on the fingers of 1 hand. Their experience with the first that were put into service was not such as to encourage them in pushing them against the well known and much more readily accessible horizontal type, but lately there has been an undoubted demand for such engines from electrical contractors interested in the equipment of smaller public generating stations and in the illumination of large private and public buildings which seemed to warrant some further efforts being made to overcome the difficulties encountered. This being so, other makers have entered the field and competition is now more keen.

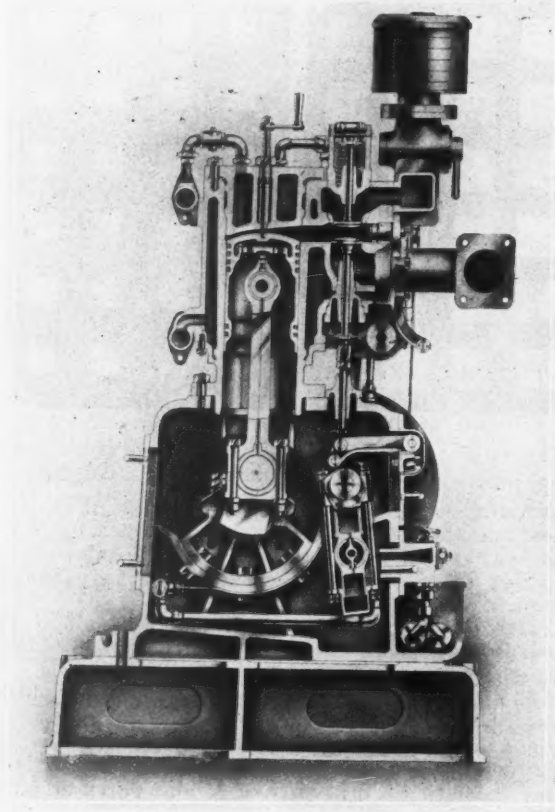


FIG. 1. SECTION OF CYLINDER AND VALVE GEAR OF 4-CYLINDER GAS ENGINE

The bulk of the makers, however, offer engines which have 2, 3, or 4 cylinders and are designed to run at moderate speeds, say, from 200 to 300 r.p.m. Others have given special attention to engines suitable for direct coupling to pumps, dynamos, etc., and running up to 600 r.p.m. The most recent type of this class of engine is that made by the Anderston Foundry Co., Ltd., of Glasgow, of which a sectional view is shown here.

The design of the engine is the outcome of experience obtained with engines of similar type and embodies several new features, not so much in the general arrangement of parts as in points of detail. Accessibility and efficient governing have been specially borne in mind, while the details connected with adjustable ignition, timing for each separate cylinder, and uniform variation in all when required, have also been carefully thought out.

From the longitudinal section it will be seen that the bed-plate is a strongly ribbed casting carrying the engine and forming an abutment for a similar casting to be bolted thereto to support the driven machine when direct coupling is desired. This crank casing provides the support for the crankshaft journals, the bearings for the cam shaft, and for the 4 cylinders, each of which are separate castings provided with a flange which is bolted to the top of the crank casing in the manner shown.

Crankshaft and Bearings

FROM the end view it will be noticed that the main bearings are supported by quadrant shaped castings which are received in suitably curved shelves formed on each of the division walls of the crank casing. The whole of the crank shaft and bearings can thus be taken out for inspection or renewal through an aperature in 1 end of the casing against which the flywheel is fitted.

In a similar manner the cam shaft and its bearings may also be removed, the latter being of a diameter larger than the throw of the cams themselves. The cams are separately keyed on the shaft and are made of mild steel, case hardened. For each cylinder a handle is fitted, permitting the exhaust valve cam to slide parallel with the axis of the shaft and to thus bring into gear the half compression cam for starting purposes.

The cam shaft is driven from the governor end of the crank casing by means of 2 to 1 gearing and the motion of the cams is imparted to the valve rods through the medium of pivoted levers and adjustable push rods, the latter passing through long guides bolted through the top of the crank casing.

Valves and Valve Gear

VALVES are housed in a projection from the main cylinder casting, leaving the cylinder cover entirely clear of mechanism and thus facilitating the ready removal of the piston whenever it may be necessary. The inverted inlet valves are operated by long push rods and levers, and are contained in a separate box, which when removed permits the removal of the exhaust valve which seats directly upon the main casting. From the drawing it will be seen that the exhaust valve guide is a separate casting giving an extremely long bearing surface, securing good alignment and considerably lengthening the life of the valve spindles by preventing leakage.

In addition to the 2 main valves, 2 out of the 4 cylinders are fitted with screw down valves in the center of the top cylinder covers by means of which compressed air can be admitted for starting purposes. A distributing box mounted on the governor casing admits the compressed air in turn to the proper cylinder.

All the valve gear is adjustable at every point so as to permit individual regulation and adjustment. The valve motion is accessible for inspection and, by means of small doors provided in the upper portion of the crank casing, the cams can also be disclosed to view whenever necessary even when the engine is working at full speed and power.

The mixture is admitted to the valve chests from a main of rectangular section which passes in front of the engine. The gas enters this main at 1 end of the engine through a tapered cock of the usual type. Immediately upon the engine side of this cock is fitted a double beat valve which is operated by the governor, throttling the supply more or less according to the load upon the engine. Thus it will be seen that the method of governing is by variation of the quality of the charge and not by variable admission of a mixture of constant quality. The latter method would be likely to give trouble in an engine of this class because the variable compression pressure that would then take place, on account of the inertia forces brought into play at such high speeds, might set up vibration and thudding.

Close to the governing valve, the air is admitted to the main at right angles to the flow of the gas. It will be seen from the drawing that the air passes through a silencing chamber composed of 6 superimposed plates so designed that the inlet passages at the topmost plate are of larger total area than the similar passages in connection with the bottom plate. In this way the air is admitted in practically proportionate volume throughout, the silencer preventing undue noise. Below the silencer a plug cock is provided so that the proportions of air and gas may be adjusted to suit gas of varying quality.

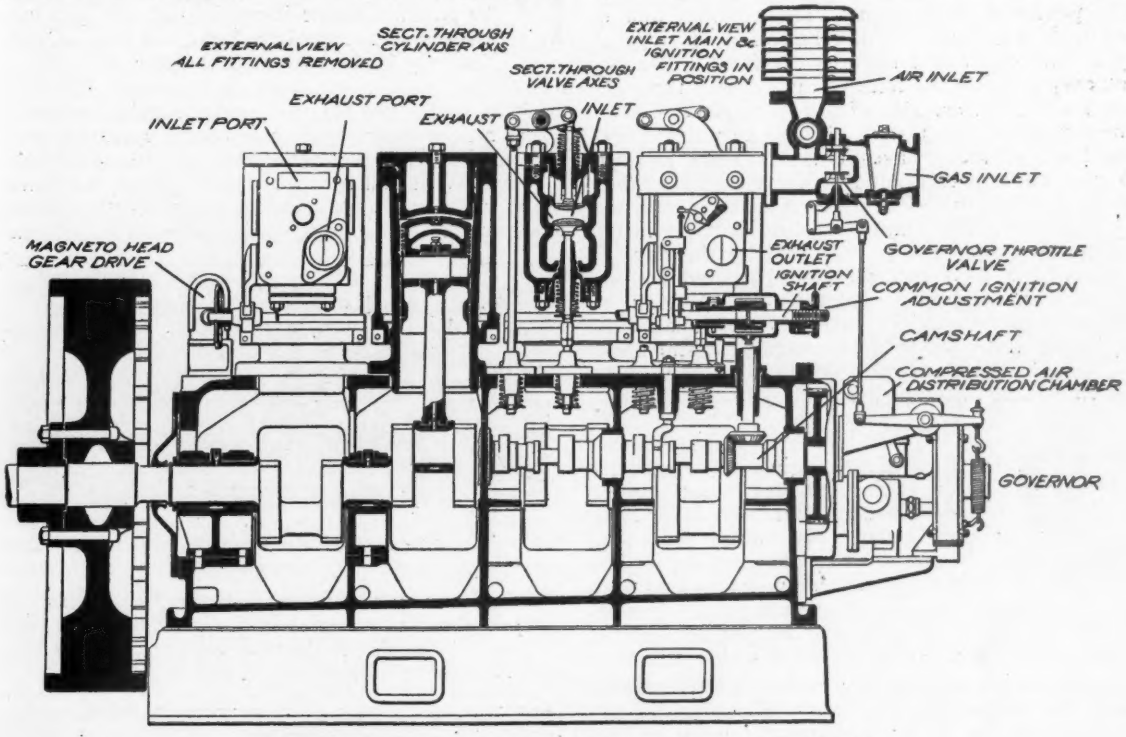


FIG. 2. LONGITUDINAL SECTION OF 4-CYLINDER GAS ENGINE

The exhaust gases are led from each cylinder in a common trunk that extends the whole length of the cylinder a little distance below the mixture main.

Cylinder and Piston

THE cylinder casting forms both the working barrel and also the water jacket, but provides for unequal expansion of these walls, the external portion is open at its lower end, being cast several inches shorter than the working barrel which extends to the crank chamber, these terminating in a flange which forms the connection between the 2 main castings. At the base of the outer wall a split cover is provided

so that, with the interposition of suitable packing material, a water tight joint is made of a nature to respond to the different rates of expansion and contraction that take place at this point.

The cooling water passes from the base of the jacket upwards around the cylinder and the valve chambers and thence to the cylinder covers. From these it flows to a common outlet pipe. Each cylinder is connected in parallel across an inlet and an outlet pipe common to all.

The cylinder cover is a deep well-cooled casting which can be removed with comparative ease owing to the absence of valve gear connected thereto. When it is necessary to remove the pistons they can be drawn upwards through the space blocked up by the cylinder cover, without more preliminary trouble than is occasioned by the uncoupling of the big end bearing of the connecting rod, to which access is gained through the door of the crank chamber.

The piston is an extremely long casting and is turned with 6 grooves for the reception of rings, 4 being in the back and 2 towards the front. The latter not only equalize the wear of the cylinder throughout its length, but are also of use in connection with the lubrication of the piston. It will be noticed that at the back of the grooves 2 downwardly inclined holes may be seen through which excess oil scraped from the walls by the front rings is directed into the crank chamber. The amount of lubricant permitted to escape by this means is regulated by the number and size of the holes that are placed around the circumference of the piston, and thus the condition of the cylinder as regards lubrication is more than ordinarily under the control of the attendant, and backfiring through excess of oil becoming deposited upon the working face of the piston is altogether avoided.

Lubrication

GENERAL lubrication of the engine is provided for by means of an oscillating valveless pump worked by an eccentric from the cam shaft and circulating the oil, under pressure, through distributing pipes connected to all the bearings. The plungers are in one piece and rock upon a central trunnion provided with ports. The pump barrels are connected to the eccentric strap by long bolts and reciprocate on the oscillating plungers, giving a double-acting effect.

The piston pin is oiled by means of a long passage through the connecting rod from the crank pin bearing into which the oil is forced by the pump just referred to. The piston itself is, of course, separately fed with fresh oil delivered to an annular ring or groove cut in the walls of the cylinder, adjustment being provided by means of which the number of drops per minute can be regulated.

Ignition

FROM 1 end of the cam shaft a pair of gear wheels and a vertical shaft give motion to another shaft running the whole length of the engine by means of skew gears upon the latter. One wheel of this pair can be moved with relation to the other by means of a handle on the end of the shaft. By such adjustment, it is possible to vary the time of firing in all cylinders simultaneously.

The ignition shaft drives a rotating low tension magneto common to all cylinders and also the make and break gear for the sparking plugs. If desired an alternative method of ignition can be supplied in addition to the low tension system, such as the Lodge high-tension system. The same ignition shaft accommodates either or both.

Test Results

FROM figures published by the makers it appears that one of these engines having 4 cylinders 8 in. in diameter and strokes of 7 in., running at the average speed of 592 r.p.m., delivered an average of 69.7 b.hp. throughout a test lasting 20 hr. The consumption of gas was at the rate of 14.09 cu. ft. per b.hp. hr., the calorific value being 650 B.t.u. per cu. ft.

Upon the same authority it is stated that continual trials pointed to the fact that the speed variation between full and no load never exceeded the momentary variation of 4.85 per cent, while the settled variation was only 1.7 per cent.

GASOLINE FARMING

POWER on the farm is rapidly gaining ground and the gasoline engine is making its way into fields where draft animals have heretofore been supreme. Not only is the power plant taking the place of hand labor in the work about the buildings, but in the fields as well. The traction engine applied to the different processes has made more rapid operation possible and cheapened the cost of farm operations. Through our own West and the Northwest of both the United States and Canada the gasoline engine is the main dependence for heavy draft work, and even in backward

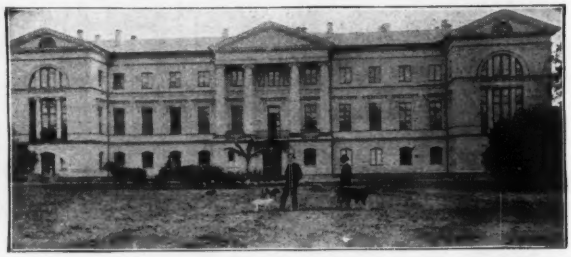


FIG. 1. MANURE SPREADER AT THE PALACE OF PRINCE LIEVEN

Russia the tractor is coming into use. Russia last year jumped ahead of America in the production of wheat, the result being due to the widespread use of the American gasoline engine in Russia and Siberia.

FIG. 2. GASOLINE TRACTOR BOUGHT FROM INTERNATIONAL HARVESTER CO. BY PRINCE LIEVEN

The illustrations herewith show 2 applications, Fig. 1 being a spreader and Fig. 2 a gasoline tractor, both of them on the estate of Prince A. Lieven, who has been particularly active in the introduction of power machinery and is one of the most progressive of Russian agriculturists. Both pieces of apparatus shown were sold to Prince Lieven by the International Harvester Co.

HOW THE NEW CHIEF MADE GOOD

THE COMPLETED JOB

By Geo. H. Wallace

SEVERAL weeks passed after Willard's encounter with the salesman from the Oshkosh Engine and Machine Co.—the salesman with the little mallet. Things had been crowding fast. Hundreds of little perplexing questions arose every day, every hour, that must be answered at once and right; no waiting a few days to see how things would "pan out," but must be worked down to a fine point immediately and settled for all time.

One of the hardest propositions he had to deal with was the standardization of materials, and it was quite a problem to sign up for all the pumps from one firm to the exclusion of all others, many of them perhaps equally good.

The same way on valves. It was hard to say, "Shall I use Smith valves, or Brown, or Jones?" Finally he found that on the vacuum heating system, for instance, a certain make of valve was superior to all others and he specified them for this particular work. Every valve on the main steam pipe line was confined to another excellent make, while all other steam valves in the plant were in a class by themselves and all water valves, hot or cold, were of a standard type of gate valve. Thus the Chief standardized his valves in such a manner that the amount of repairs and extras that were required to be kept on hand would be reduced to a minimum.

The temporary main from the boilers down through the tunnel had been laid. A gate valve with a flange union close by had been provided for near each of the old engines and all was in readiness for steam. Fires were lighted under the new boilers and steam raised for the first time, a sharp lookout being kept for all the "little things" that crop up at such times.

Slowly the valve was opened leading to the purifier, and the boiler-feed pump tried out with satisfaction. The boilers were blown down a little, "skimmed" a little and pumped up again several times to work out the surplus oil, grease and sediment that constitutes the principal troubles of a new boiler installation.

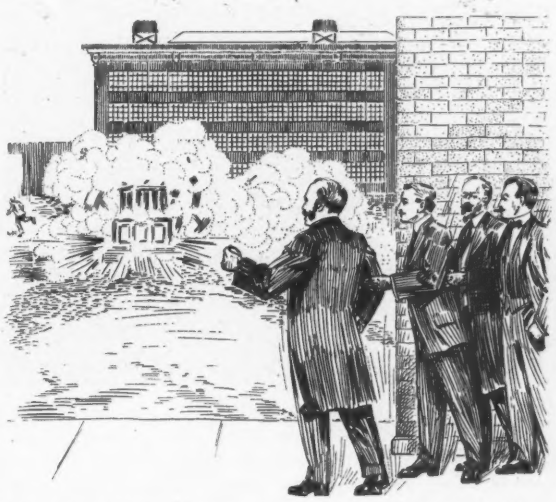
The safety valves had been "backed down" to about 110 lb., and all set as close as possible. Having satisfied himself that all was well, Willard gave orders to hitch on one of the old engines. Pipe was connected from the master valve in the tunnel up to a flange conveniently located in the pipe line from the engine to the old boiler.

At the noon hour one day, the old boiler was "cut out" for the last time, the flange disconnected and the boiler section swung to one side, while the new line was swung into its place and bolted together. At one o'clock the old engine started up with 100 lb. of steam instead of 70. It frisked off with its load like a young farm horse just released from the plow.

Willard walked around it, felt of the bearings, looked at it and finally put on the indicator. Taking several cards he went over to the office to compare notes with some that had been taken at a lower pressure. All things considered the results were entirely satisfactory.

Thus the good work went on in such a manner that all changes were made either at noon or during an hour or two after 6 o'clock. Willard always tried to arrange affairs so that no work would be done Sunday or nights unless it was absolutely impossible to do it at any other time. He was always a believer in the fact that a man who works all day and every day, with half the night thrown in, is an expensive luxury. For not only does the work cost more, even at single pay for overtime, but the men through irregular hours become tired, careless, and even reckless, and soon lose interest in the work.

Finally they got as far as Fritz's old boxbed slide valve, double barreled, back-action, name-blown-in-the-bottle, anti-profanity engine. The steam fitters pulled, yanked and twisted and finally had a 4-in. flange wobbling in the air back of the old Nordberg governor. Fritz watched it all carefully and with many misgivings. At noon the old boiler was cut out and almost before the engine had stopped the fitters were busy



"GO IT SAL, GO IT! CONFOUND YOU, YOU HAVE COST ME 800,000 DOL"—(BOOM)—"LARS. GO IT!"

with the bolts. By 1 o'clock all was in readiness and Fritz started up the old engine now connected by way of the tunnel to the new boilers.

Willard came in only to find Fritz firing up the now useless boiler, as of yore.

"Fritz, what are you doing? Don't you know that boiler is not connected to anything now?"

"Aber Misser Villard, Ay should make some schteam ter plow der vissle?" and suiting the action to the word he reached for the well-greased whistle cord but before he could tighten his grip on it there boomed out upon the air the musical notes of a mammoth whistle over on the new power house.

"Ach! Ach! Vos is—" and his muscular arms dropped to his sides while tears sprang to his eyes. "Ach! mein heart ist proken, mein heart ist proken. Feirst, de agents not pring some more cigars, den you take away mein old poilers, und now you should take avay mein vissle! Ach, mein Gott! Dot vos too mutch. Ay vish ay should die," and he went about his old engine oiling and wiping, with tears streaming down his cheeks.

The affection which Fritz showed for his old boiler and whistle, to say nothing of the stogies touched Wil-

lard's heart. He sat before his desk some little time thinking over the little incident when he was startled by Fritz's picturesque remark beside him,

"Misser Villard, Ay vonts to design my chob."

"You want to quit, Fritz? What for?"

"Vell, now dat Ay got no poiler to fire, Ay gots nottings to do. Ay guess Ay gets a chob some platz else. Ay vonts to quit."

"No you don't want to quit, Fritz. You only think that because there are no shavings to fire that I'm going to fire you. You just stay right there and take care of that engine. If you want a little exercise, empty that old boiler and take the trimmings off and knock the brickwork down. You don't have to do it, Fritz, only if you want to, for exercise."

"Vell, den, Ay not design; Ay stick py der big show," and Fritz thus assured that he wouldn't be turned out to grass like an old horse, went merrily about his allotted task.

At last all of the old engines were connected to the new boilers except the $800,000 gas engine, and this

THE NEW CHIEF AND HIS BRIDE

kept up a merry kapunk, kapeet, kapunk, kabing, with many a bang and many a jingle, Willard meanwhile holding his breath for fear it would get heart failure before the new engines would be installed.

One of the old steam engines also balked a little under the higher steam pressure, and blew out a gasket on the steam chest several times owing to the surface being well rounded off with time—and a cold chisel. But an engineer who doesn't have trouble occasionally soon unconsciously drifts out of the fine points of the business.

While all this was going on the new factories had been going up under the direction of Superintendent Mather, and ere long new machinery was installed and the old rearranged as far as the old belt drives would permit. Gradually the cost of the finished product was reduced and better men were being secured. John Gautelbeim rarely appeared about the works any more. If he did it was more in the form of a "constitutional walk" than a campaign of a perpetual war as was formerly the case.

Willard had long since learned the direction to the Gautelbeim home, but his visits with the old man had ceased altogether and Dorothy had become the sole attraction.

One evening something happened. Nobody knew how, or why, or what. Anyway Willard stepped from the parlor into the library, where John was reading the evening paper. Nobody knows what happened first there. Nobody ever does under similar circumstances. The two men talked for some time, on the weather, politics and everything else, almost. Finally Willard said something of real importance. John jumped from his chair, slapped the Chief on the back several times with vigor, and said:

"Sure you can, Willard, sure you can, take her, my boy, and may the Lord bless you both."

Willard didn't walk home that night; he floated along like a gentle zephyr. His biggest trouble had been settled and everybody was happy.

Finally the new engines began to arrive and at the end of several weeks were erected. The generators were connected to the switchboard, and every connection gone over carefully. The oiling systems were attached and every detail completed.

Motors had been installed throughout the works and enough new machines attached to them in running order so that work could be transferred to them from the old belt-driven ones. At last the great day of days arrived. Fritz had been given an understudy who looked after his old rattletrap engine while Fritz was over taking lessons in up-to-date powerhouse apparatus.

Everything being in readiness the cylinders warmed up, the oil flowing and the condensers in operation, the erecting engineer, Bill Brewer, carefully opened the bypass on the throttle, and slowly the wheel began to move.

In the course of a couple of hours the engine had been brought up to speed for the first time and run for several minutes. Shutting down several times to make slight alterations in the valve gear and adjusting the pins and bearings, the engine was finally brought up to speed, and the generator voltage built up, after which a few motors were started by the electrician and his assistants.

This light load held the engine down very well and one by one more motors were added, which, with the lights thrown on, made quite a respectable load for a new engine, yet it dug right into it like an old timer.

The other engines were but a repetition of the first one and almost before he knew it Willard had the entire works switched over from his old style engines and boilers to his new, modern powerhouse with electric transmissions without interfering with the operation of the factory and without the proverbial hotbox which usually goes with a new engine.

When assured that the new engines were equal to all demands, Willard hired a specialist to come up and demolish the old engines, especially the larger ones. John Gautelbeim, the chairman of the Board of Directors, came out on the day of the "housecleaning," followed at a respectful distance by the entire board (for they still feared him even though he was thoroughly "broken to saddle") and they watched preparations being made to forcibly remove the gas engine from the premises.

"How much of that magoozlum are you going to put in under that infernal machine?" asked John of the man of dynamite.

"Oh, about so much," said the latter evasively.

"Oh, say, that isn't enough, that wouldn't blow out a candle. Put in a couple of sticks! Put in a whole keg!" yelled John with boyish excitement, "Blow it all to ——. I don't ever want to see a piece of it again!"

The fuse was lighted and everybody cut for cover—everybody but old John. He stood right out there in the factory yard yelling like an Apache. "Go it, Sal, Go it! Confound you, you cost me 800,000 Dol"—

(Boom!) "lars, Go it!" and as a few stray pieces whistled close to him like shrapnel he enjoyed it as much as did Napoleon the charge of the Lancers at Waterloo.

When the smoke cleared away there stood a badly battered and shattered old gas engine, the last relic of the age of barbarism through which the firm of Baum and Gautelbeim had passed.

When the new plant had been in operation a couple of months Gautelbeim came in one day with the erecting engineer from the engine company.

"Mr. Willard," said he, "I've decided to make a change in the management of our powerhouse and have hired this man to come down here and run things while you take a vacation for a month. Ha! ha! ha! Willard, you thought I was going to fire you, didn't you? Well, that's one on you. You've made good, old man, with a big margin, and beginning today your pay goes up $25 a month. Now, you take your substitute in hand for a while and then come into the office," saying which, John left the engine room.

Willard was so surprised that he couldn't talk, so he just followed John right into his office.

"Mr. Gautelbeim, how about that little matter I spoke to you about some time ago?" said Willard.

"You settle that with Dorothy, and if she is satisfied, I am."

And if anybody recalls seeing a young married couple at the N. A. S. E. convention at Rochester they will know that it was Mr. and Mrs. George Willard.

The End.

ECONOMY OF OVERLOAD BOILER CAPACITY

IN THE design of large power plants a unit employed with increasing frequency is horsepower per cubic foot, or possibly kilowatts per square foot. Especially in city installations this ratio of power capacity to volume or to the area of the installation is of the first importance.

One advantage of the present-day steam turbine lies in the small space occupied per horsepower. In modern plants the boiler room floor space is much greater than the engine room space and a saving in the former naturally gives a larger percentage return than in the latter. If then it is thus possible to economize on the capital investment in the engine room, how can similar economies be accomplished in the boiler room? The answer is, overload boiler capacity.

If a boiler of, say, 500 boiler hp. normal rating can be made to evaporate water at a rate corresponding to 1000 hp., it is obvious that the boiler house capacity has been doubled without enlarging the premises or increasing overhead expense such as attendance charges, general labor, taxes, insurance, investment, etc.

A set of tests recently conducted by the engineering staff of the New York Edison Co. at the Waterside station, on a 650-hp. Babcock & Wilcox boiler equipped with a Taylor Gravity Underfeed Stoker showed some remarkable results regarding overload operation.

At 50 per cent overload the horsepower developed was 824, the evaporation from and at 212 deg. was 11.8 lb. and the over-all efficiency 79.6 per cent. At maximum overload, the horsepower was 1279, the evaporation from and at 212 deg. 10.9 lb. and the over-all efficiency 73.6 per cent; this was 192 per cent of rated capacity; flue temperature was 488 deg. F.

From 125 per cent of rated capacity to 192 per cent, the combined efficiency dropped only 7.1 per cent or from 79.8 per cent to 72.7 per cent. The generally high average of efficiency and its remarkable steadiness at high overloads is probably due to the absolute control of both coal and air peculiar to this type of stoker. That the Taylor stoker regulates combustion closely regardless of the load conditions, is evident from the slight change in boiler efficiency and also from the high percentage of carbon dioxide and the absence of monoxide.

Low flue temperatures obtained on these tests, only 488 deg. F. at 92 per cent overload, speak volumes for the thoroughness of combustion. The underfeed principle combined with gravity cleaning make this possible as no matter how fast the coal is burned, it must be coked before it reaches the fuel bed and the distilled gases cannot escape unconsumed as their path is through the heart of the fire.

The fact that no moving parts come near the fire keeps the cost of repairs down to a minimum. The gravity cleaning feature insures low labor costs. The air tuyeres are always covered with green coal and cooled by the blast while the rams are at some distance from the inside of the furnace.

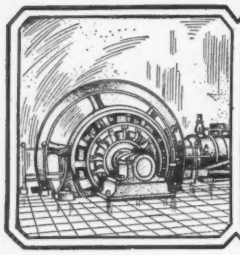
PECULIAR VERDICT

THE official verdict of the coroner on the boiler explosion at Canton in May is one which will appeal to engineers as a model of incorrect use of terms, whether or not it be in agreement with the facts. The report states that the explosion was due to "water hammer." The attendant, whose body was thrown into the air, is found by the coroner to have cut boiler No. 2 into the battery of boilers and this caused a sudden and unusual increase of pressure, which caused the explosion. He continues: "A water hammer consists of the rapid vaporization of the water in a boiler, when a boiler of low pressure is too rapidly connected with, or 'cut into' a battery of boilers of relatively high pressure. I can think of no other cause for Mr. Austin's body having been thrown as it was with such force, except that he was on top of the boiler when it let go, the exact position he would have been in if engaged in 'cutting in' the boiler."

Evidently the coroner's understanding of water hammer is a new one. While it has been known to smash pipe fittings and raise Cain generally around a plant, this is the first time that it has been accused of causing a boiler explosion, and the method of causing water hammer by letting up on the pressure of the steam in a boiler is also a new one.

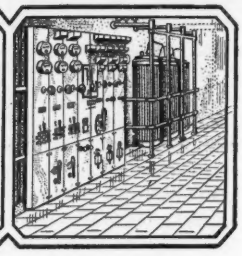
From what was ascertained with regard to condition of the boilers, the time that they had been shut down and other details, it would seem that the coroner's verdict is something closely resembling a coat of white wash, and if the coroner had been more conversant with the way things go in a boiler explosion he might have conceded other possible causes for the distance that the attendant was thrown than that he was on top of the boiler.

While it is unwise to cut a boiler at low pressure in on a battery of boilers running at high pressure, it is not a thing which with boilers in proper condition ought to be productive of any such disastrous results as those which ensued in the case of the Canton explosion.



Electrical Machinery

For Generating, Transmitting and Using Current



MILL LIGHTING

By R. E. Campbell*

QUITE recently, considerable attention has been given to mill lighting and especially to steel mill lighting. This particular field remained long undeveloped, not so much due to the difficulties to be met, as from a lack of effort by the various manufacturers of illuminants to interest the mill owners in high efficiency illumination.

COMPOSITE LIGHTING IN A TUBE MILL USING MAZDA CLUSTERS

The results, as shown in the more progressive mills, many of which are now lighted by the new Mazda Cluster, have fully justified the attention which has been given, for not only has the mill output in most cases been increased from 1 to 3 per cent, but the quality of the product has proportionately improved, due to the greater satisfaction among the employes. Exhaustive statistics gathered by the Fidelity & Casualty Co. of New York also show that the better the illumination the greater the reduction in the liability of accident. The reasons cited above should be sufficient to warrant a change from the old haphazard system of illumination to the more satisfactory and efficient lighting of today.

*Engineering Dept., Nat'l Elec. Lamp Association.

Classes of Lighting

MILL illumination may be roughly divided into 3 classes, viz., general, specific and composite illumination. General illumination is secured by a number of high candlepower sources, which give approximately a daylight effect. This is the most desirable method, and is the one to be recommended as far as circumstances permit. Specific illumination, although at present quite common, is not to be recommended, except in special cases where the quality of work on a machine depends absolutely upon good illumination at a certain point, for the reason that the shadows which are very deep at every point except the working point cause the readjustment of the eyes every time the workman looks up from his machine, thus producing excessive eye fatigue. The third class, known as composite illumination, is a combination of the 2 above mentioned classes and is the one which most readily adapts itself to the average mill conditions. This is secured by the adoption of high candlepower units for lighting the entire area, while low candlepower units are used where specific lighting is desired.

Of course, the latter class is capable of almost any combination, the relative components being determined by the individual conditions to be fulfilled. As the majority of iron and steel mills and shops use a traveling crane, long suspension cords, hung below the crane area, are prohibited. This necessitates the almost exclusive use of general illumination, except where the specific lighting of some machine is indispensable. The units which are available for the purpose of general illumination are so few, and the conditions to be complied with so exacting that it will be necessary to give a few of the relative advantages and disadvantages of the various illuminants.

4 Typical Lighting Units

THE common enclosed type of carbon arc was the first high power unit on the market, with the Cooper-Hewitt Mercury Vapor lamp and the Flaming Arc lamp next, in the order named. The Mazda Cluster is the latest development in the field of high power illuminants and has already attained an enviable reputation. It consists of 4 series style Mazda lamps wired in series or in parallel-series depending upon voltage conditions, all grouped under an enameled steel reflector which affords an even distribution of light on the plane of illumination. Rugged low-voltage metal filaments are used which are strong enough to withstand the rough usage that they receive in a steel mill, thus reducing breakage to a minimum.

Initial Cost

ONE of the most important considerations entering into the choice of a lighting system is the item of initial cost. For instance, if one system costs twice as much as another, the cheaper installation could be replaced twice as often with an equal depreciation charge. Thus advantage could be taken of the various improvements made in high candlepower units by installing the cheaper system. Maintenance cost is also important and is somewhat dependent upon the intitial cost since it is made up of insurance, taxes, interest and depreciation as well as the actual materials and labor employed to keep the lamp in operation.

In order to reduce the costs for the various illuminants to be considered to a common basis it is necessary to figure them on the candlepower emitted, for example, as cost per 1000 candlepower. Taking this into consideration the usual installation of the Mercury Vapor lamp has the highest initial cost, while the corresponding initial cost of the Mazda Cluster is much lower, the carbon arc and the flaming arc falling between these 2 extremes in the order named.

Maintenance

FLAMING arcs have the greatest cost of maintenance due to the skilled labor required to fix any derangement of the complex regulating mechanism and also the necessity of frequent trimming with expensive carbons.

Mercury Vapor lamps also show a high maintenance cost on account of the high initial cost which proportionately increases the interest, taxes and depreciation charge. This lamp, however, requires little attention except to renew a leaky tube or to adjust the starting mechanism.

Carbon arc lamps must be trimmed once every 100 hr. and when burned over 1000 hr. a year, the depreciation is greater than the usual 10 per cent charge; thus its maintenance cost is relatively high.

Mazda Clusters on the other hand have no mechanism to get out of order, require little or no attention, have a comparatively low initial cost, and are therefore exceedingly economical to maintain.

Efficiency of Lights

ANOTHER vital factor in the choice of a lighting unit is its useful light efficiency, or in other words, the wattage consumption per mean lower hemispherical candlepower. Numerous tests show that the efficiency of the flaming arc lamp is unquestionably higher than of any of the other types considered here. The exact relative positions of the Mazda Cluster and the Mercury Vapor lamp are in doubt owing to uncertainty as to the actual candlepower of the Mercury Vapor lamp, various measures of which show different values due to differences in the method of making a photometric comparison.

Carbon arcs, although showing the lowest efficiency of all, are still used to a considerable extent, since they were the first high power illuminants on the market. In many shops, however, where regard is had for economy of operation they are gradually being replaced by the newer and more efficient types.

Flexibility of System

INTERCHANGEABILITY of a system is another feature which is important, although generally neglected. As nearly all steel mills take advantage of every improvement in operating machinery, it is often the case that alternating current is used for power, and direct current for lighting. This means that the direct-current generator must lie idle except on dark days and during the night shift. Now as the alternating current is generally used at 25 cycles, it is evident that a lamp to be burned on the power circuit must be capable of satisfactory operation without flicker at that frequency. The only lamps capable of this are the Mercury Vapor lamp and the Mazda Cluster, the latter being the only lamp of the 4 which is capable of giving entire satisfaction on either alternating or direct current circuits interchangeably.

Shadows and Colors

CLEAREST seeing is attained with a daylight effect which implies an absence of deep shadows as against a sunlight effect. Thus the light source which most nearly approaches daylight in this particular is the one which, other things being equal, is the easiest to work by. This condition the Mercury Vapor lamp and the Mazda Cluster fulfil admirably. Both the Mercury Vapor lamp and the Mazda Cluster give an approximately even distribution of intensity on the

plane of illumination, this being necessary in order to secure the maximum working efficiency.

Color of light undoubtedly has a psychological effect on employes and the nearer the approach to the pure white of daylight the greater amount of work they can handle without fatigue. The closest approximation to this ideal condition is at present the clear white light of the Mazda Cluster.

Recently an installation of 8 400-watt Mazda Clusters was placed in an Ohio tube mill and was so successful from the first that the employes have been asking for the complete installation of the cluster. There are at present 4 carbon arcs, 2 Mercury Vapor lamps, 2 flaming arc lamps, and 8 400-watt Mazda Clusters in the mill. A test run by an illuminating engineer on the flaming arcs and 2 of the Mazda Clusters, each operating under equal conditions, showed over 12 per cent greater average intensity on the plane of illumination in the area lighted by the Mazda Clusters.

Comprehensive view of the whole field leads to the conclusion that the Mazda Cluster makes a near approach to the ideal illuminant for mill and shop lighting. Its economy of operation, its low initial cost, the striking similarity of its light to daylight and the resulting increase in output are all influential factors in the selection of a system of illumination.

SHUTTING DOWN

REPAIRS TO ICE MACHINES AND PLANTS

By Wm. S. Luckenbach

AS THE TIME IS again approaching when repairs, alterations and additions to ice and refrigerating machines must be considered by every owner and engineer it behooves the engineer to make notes of any shortcomings of his machinery in order to determine to a certainty the parts that are deficient. If he has kept a record during the past season of the fuel consumed, temperature of feed water, cooling water, liquid ammonia at the expansion valve, poor liquor before entering the absorber and internal temperature of absorber, he will have no difficulty in determining improvements to the plant at the least expense. If, however, the temperatures mentioned have not been recorded by reason of the necessary instruments not having been installed on his machine, then careful observation and good judgment are absolutely essential.

After having decided as to the requirements, make a record of them in regular order and do not depend on memory even to a single fitting in some obscure place for fear it will be forgotten until the machine is again in operation; especially is this important throughout the ammonia system.

See that all new parts, as nearly as possible, are on hand before you shut down so there will be no delay in again having the plant ready for operation as soon as possible, especially if the plant consists of only one unit, and in that case, make the repairs in detail so that in case of emergency you can start upon a few days' notice.

Shutting Down for Repairs

IN shutting down several things are to be considered. If the absorber has not been opened for several seasons, it should be done and the tubes or coils thoroughly cleaned and tested; this, of course, requires the storing of the ammonia. The generator will require the same treatment, and the coils in the freezing tank may need the same treatment, in which event the brine can be stored in the ice cans, if it is an ice machine. If, however, you are sure that the coils are in good shape and not likely to clog internally during the next season, and that the brine tank is tight, there will be nothing to do but freeze down. After the cans are frozen solid, shut down for say 5 hr. then put the brine as low as possible.

If the return gas passes through a distilled-water cooling tank (as it should do) it must be bypassed as soon as the cans are all filled to avoid freezing the water in the tank and bursting it, or the water can be allowed to flow elsewhere through the canfiller hose and by that means keep up circulation through the tank and prevent freezing.

Distillation

WHEN shutting down for repairs, the usual method is to work the machine towards the latter end of the season with as little ammonia as possible, and in order to have the balance compact increase its density to not less than 26 degrees Baume by distillation, thus decreasing the number of drums or other tanks required for storing the ammonia.

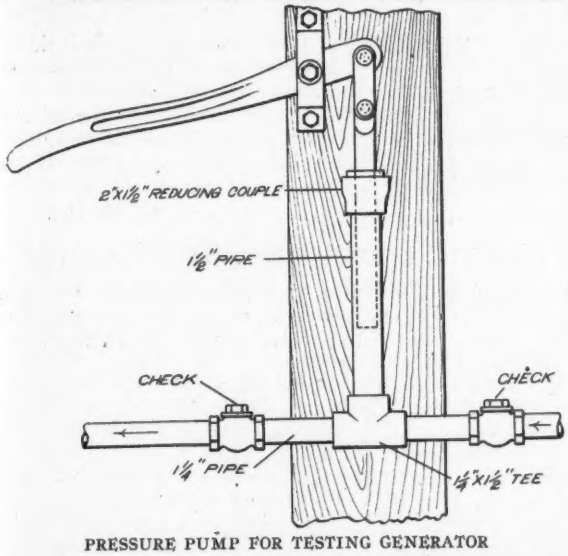
In order to know approximately the amount to draw off after distillation at say 12 degrees Baume, containing about 2 per cent of ammonia, we will suppose that the original charge was 20,000 lb., but by figuring the cubic contents in the absorber, generator, condensing coils, etc., you find that there is only 15,000 lb. left at 24 degrees. By referring to the table of percentage of anhydrous in aqua ammonia, we find that at 26 degrees Baume there is 28.6 per cent ammonia and the balance is water, and at 24 degrees 24.2 per cent, hence $15{,}000 \times 0.286 = 4290$ lb. of ammonia and $15{,}000 \times 0.242 = 3630$ lb., and the difference, $4290 - 3630 = 660$ lb. of ammonia, would have to be added to bring the whole charge of 15,000 lb. up to 26 degrees. But as we do not wish to add more ammonia at present, we draw off enough aqua, or water, to bring the balance up to standard and as 660 lb. is about one-third we simply double that quantity, making approximately two-thirds of the whole or 1320 lb. after distilling to 11 or 12 degrees.

Of the various methods of distilling one is to fill the generator as full as you can without causing a boilover; then stop the ammonia pump and close the poor liquor valve at the generator, but continue the cooling water on the condensing coils, and when the generator pressure is down to say, 40 lb., draw some aqua ammonia and test it. If it is not down to 11 or 12 degrees, continue the steam on the generator until the test is satisfactory; then close the steam valve, also the gas valve leading to the condensing coils and, if there is no special work to do on those coils, close the expansion valve tight and draw off the required amount.

If the poor liquor returns to the absorber by gravity, it may be necessary while distilling to close the poor liquor valve near the absorber to avoid filling it. This will leave no room for the surplus gas from the generator and it will be absorbed, which will probably

increase the liquid density to 28 degrees Baume, but it will again be equalized by the poor liquor in the coils.

The reason for using this method is that the distillation of one generator full is usually sufficient and it can be done in a few hours. If there is nothing to do on the condensing coils, close the expansion valve tight and you are ready to store the ammonia by breaking the discharge pipe connection and running a pipe or hose to a drum. When all has been withdrawn from the freezing and poor liquor coils and the



PRESSURE PUMP FOR TESTING GENERATOR

absorber, treat the generator in the same manner, and the loss in ammonia will be very small. I would add that, if there are no repairs to be made on the poor liquor coils, close the poor liquor valves at both generator and absorber, thus making that much less to store.

Generator and Absorber

HAVE the generator and absorber pipes or coils thoroughly cleaned both externally and internally, and tested to 500 lb. pressure. If you have no pressure pump, you can easily make one by using say, 1½-in. extra heavy pipe with 1¼ by 1½ tee at the bottom for suction and discharge checks, and a 2 by 1½ reducing coupling at the top for a stuffing box. Then secure it near a post and make a lever to work the plunger.

Blow each absorber coil separately with steam in order to cut the dirt and slime that adhere to the inside of the coil; then follow with good water pressure. All coils should be drained well to prevent freezing. See that all valves are absolutely tight, especially the ammonia valves, also have the valve stems in good shape as the best of packing will not last long on corroded stems, to say nothing of the loss in ammonia and prestige of the man in charge.

Steam Boilers

ONE of the principal questions asked an operating engineer is, how much ice per ton of fuel? And while much may be due to the construction and operation of the machine proper, yet the steam boiler is frequently at fault, hence it should have a thorough going over, and any appliance that will increase its efficiency is a good investment and should be installed regardless of first cost. Among them is a first-class heater and purifier of ample capacity, because it not only heats the water to near the boiling point, but eliminates about 80 per cent of the impurities contained in the feed water, hence there is less scale formation on the tubes and also on the condensing coils. There will also be less blowing down of a lot of boiling water that has cost fuel to heat, thus not only increasing the efficiency of the boiler but also the chances of pure ice, as it is clear that the less impurities pumped into the boiler the less there are to blow out.

The high and low water alarm is another important adjunct because, if the water should accidentally get too high, the engineer would know it, no matter in what part of the plant he might be at the time, and should there be bad ice say, 48 hr. afterward, he would know the cause,—that impurities floating on top were carried over with the steam into the generator coils, and would appear in the distilled water provided that the filter was unable to take care of it. Without the alarm, if he finds bad butts, he will be apt to look almost everywhere but to the steam boiler because, when he would be in the boiler room the water would be at its proper level, yet perhaps 15 min. afterward it might accidentally get too high and cause the conscientious engineer considerable worry to locate the trouble. There are other appliances that will warrant the owner in buying them because they are installed under a guarantee. The makers keep you posted in the advertising section.

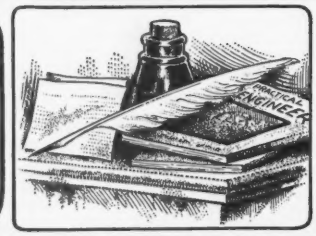
Blow-off valves should be so constructed that they will shut tight every time and not have a little stream of hot water running to waste. The writer has found that a valve with babbitt metal disk answers best because small particles that may lodge on the seat will be inbedded in the softer metal and make a tight joint, and the engineer can easily renew the joint occasionally by slipping the disk off the stem and rebabbitting. Now, with tight brick work, painted fire front and tidy boiler room generally, that department will be in good shape.

RADIATOR CONTROL

STEAM radiators are usually proportioned to heat a room comfortably in zero weather. It stands to reason that in warmer weather the radiator is too big. For with ordinary valves there is no way to cut down the steam supply without stopping it altogether. Thermostatic systems with co-ordinated control of supply and return have proved that modulation of temperature is practicable, but the cost is too great and they are too complex for small buildings.

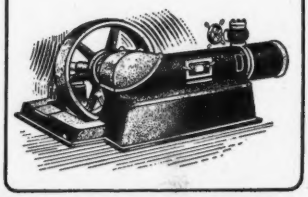
With ordinary valves on both supply and return it is impossible to graduate the steam supply or the heated surface of the radiator. The advent of the small automatic trap upon the return end, whereby the water and air could be allowed to escape without permitting steam to back up, opened the way for simple control of the rate of steam admission. But the opportunity thus presented for the modulation of temperature to the requirements of each room has not until recently been realized and even now only to a limited degree by the general public.

It is, however, possible by a proper combination of fractional supply valve and automatic discharge valve to so overcome all the objections to the ordinary arrangements for direct steam heating as to simplify control, economize steam and modulate temperature to the exact requirements.



Letters from Engineers

Bright Ideas direct from the plant. Send us yours. Cash paid for those accepted. Sketches desirable; we make the drawings

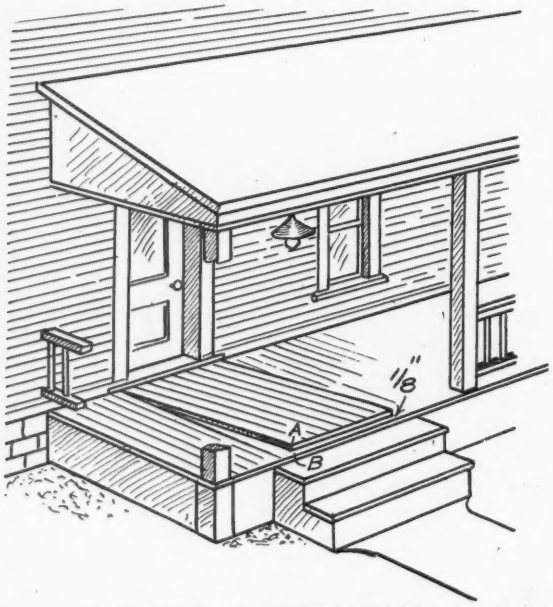


AUTOMATIC LIGHT

I FIND people using porch lights are given a flat rate in some cities of $1.50 a month per light. The only time it is necessary to have it lit is when a person is on the porch, be it a friend or foe.

I have my porch so arranged that the boards leading to the door are hinged and held ⅛ in. above the sleepers by a spring. A and B are contacts on the wire leading to the porch light, and are made weather proof.

In stepping on the porch you have light to open the door or coming out have light to see only when you need it. A burglar in lighting it, being surprised that his presence is known, will leave the place.



AUTOMATIC PORCH-LIGHT SWITCH

A meter reading of a porch light like this is hardly noticeable and the light is more valuable than when burning all the time. Wm. N.

HIGH WATER LIFT

THERE have been a number of comments on the height a pump will lift water in recent issues of Practical Engineer and I would state that I am quite satisfied with a pump that will lift water 25 or 26 ft. I once had a pump with which I lifted water 28.5 ft. At the plant where I was then employed we had dug a well about 29 ft. deep, in which the water stood 12 ft. from the surface and as we wanted to clean the well, I pumped it out.

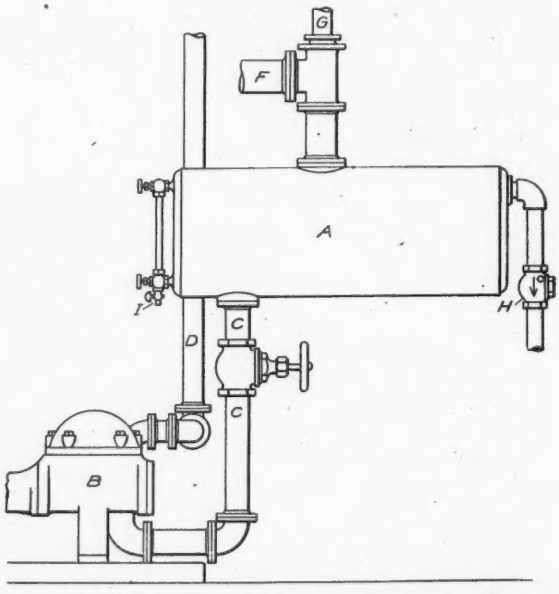
Of course there was no trouble in lifting 12 ft. to start with, but as the water got lower in the well it gave some trouble as the cylinder would not fill with water, but by keeping at it we managed to get it down very nearly to the bottom when the pump refused to deliver any more water.

I measured the distance from the surface of the water to the surface of the ground where the pump sat and it was 28 ft. The cylinder of the pump was about 6 in. above the surface, so that made 28.5 ft.

O. M. Dow.

TROUBLE IN PUMPING FROM VACUUM

IN the July number of Practical Engineer I saw a sketch of a tank, air tight, suspended over a pump; the writer asked if the water can be drawn from the tank, the tank to be filled with water before starting the pump.



ARRANGEMENT OF RETURN TANK AND PUMP

Without offering any suggestion as to whether the pump will draw the water from the tank I would like to submit the accompanying sketch and describe an occurrence which happened to me.

A represents a tank which receives the returns from a heating system, B represents the water cylinders of a duplex pump for feeding the boilers and taking its supply from the tanks through pipe D to the boilers. F is the return pipe from the heating system and G is a pipe for supplying cold water to the tank in case the returns were not sufficient to feed the boilers. H is a check valve of the swinging gate type and opening downward to the sewer—this overflow pipe connects with the sewer in 1 corner of the boiler room and the overflow from the blow-off tank entered the

sewer at about the same place, and the check H was placed here to prevent the sediment from blowing up into the tank A when the boilers were blown down.

One day I discovered that the pump was moving with a jerky motion, as though it were short of water. Inspection of the gage glass on the end of the tank showed it to be about 2/3 full, or just below the overflow pipe. After several minutes' search without locating the trouble I opened the jet-cock on the bottom of the gage glass and discovered the trouble at once.

The returns coming from the heating system were insufficient to supply the boilers and a small amount of cold water was admitted through the pipe G, this falling upon the vapor from the hot returns had created a vacuum in the tank above the water level, thereby closing the check valve H and making the tank practically air tight. Upon opening the pet-cock I air was admitted, breaking the vacuum, and the pump took water all right. C. B. Hudson.

THOSE QUEER CARDS!

IT is not surprising that the cards shown by H. C. P. in the June issue, taken from a Buckeye Engine, should cause comment.

These 4 cards taken from an engine with an 18-in. stroke are each one of a different length. This would suggest a defective reducing motion to start with. Then he writes, the cards shown in Fig. 1 were taken with a 40-lb. spring, those in Fig. 2 with a 60-lb. spring. How did he get the height of card shown from the low-pressure cylinder from this engine with a 40 and 60-lb. spring respectively? The springs should have been used in reverse order on the high-pressure cylinder anyway.

High-pressure card Fig. 1 crank end, shows late admission with the cutoff earlier than would be expected under the conditions of the admission, then too we have the loop on the expansion line which would indicate an earlier cutoff than is shown. If the steam lap on this end of the valve were too long, it would produce the conditions shown, but, if such were the case, the same defects would occur in Fig. 2, even though the valve had been readjusted as this one seems to show, unless the excess lap had been removed. There is little or no compression on this end, which of course, would cause high compression on the opposite end.

The head end of this card shows very high compression, early admission and an apparent very early cutoff with an expansion line that indicates a quick drop in pressure to about 27 lb.; just beyond this point is an almost abrupt rise in pressure to 42 lb., which is hardly possible to believe represents the true condition in the cylinder. Of course I can conceive of a very heavy load being thrown on the engine sufficient to cause a sudden drop in speed with a corresponding shifting of the governor which may possibly produce such results but it is highly improbable.

The low-pressure card of the same figure is about as much of a surprise as the first one. The head end shows a possible late admission, early cutoff and a large expansion loop, toward the end of which is an indication of an opening of the exhaust valve which, however, could not have taken place, for a little beyond this point the pressure again falls just before the exhaust opens. There is but a small part of the work done in this end of the cylinder. Crank end shows the steam line falling away too rapidly, also too quick a drop in the expansion curve. The expansion loop ought not to be on this card either.

Cards shown in Fig. 2 are much better than in Fig. 1, but are not what should be expected from this make of engine with a correct valve setting and a correct indicator rig.

With the meager information accompanying these cards a guess is about all that can be given with respect to the probable cause for the ill shaped cards.

It would be interesting to know the exact conditions surrounding the taking of these cards.

A. K. Vradenburgh.

OIL FUEL

I WOULD like to submit to the attention of readers an idea in regard to the use of crude oil suggested by its use on locomotives and ships. Why is it not practical to use it for cooking and heating in houses and hotels? If a stove is lined with asbestos and a stream of oil carried to the furnace door by gravity, and water heated in a pipe which is carried around the firebox, thus generating steam, a mixture of oil and

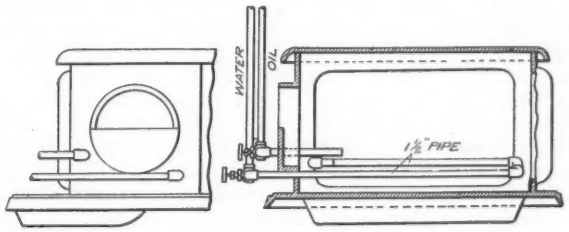


FIG. 1. PROPOSED OIL BURNER

steam could be used, giving a water vapor which would burn in the firebox and thus do away with other fuel.

I enclose a rough sketch of the proposed arrangement. First remove the firebox door and put in

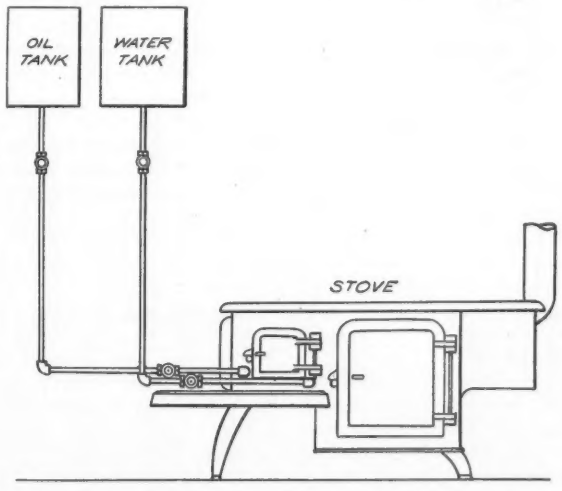


FIG. 2. ARRANGEMENT OF OIL AND WATER SUPPLY

another of the design shown herewith in Fig. 1. Carry ½-in. pipe around back of the firebox to give the steam needed and let this discharge at a point just below the end of the oil pipe, so that as the oil stream drops down the steam jet will catch it and throw it into the furnace. Oil and steam flow are to be controlled by valves from the outside. What is the verdict on this idea? F. G

OHIO LICENSE LAW

THERE appeared in September issue an article by Mr. Rounds, and also an editorial concerning the Ohio License Law and methods of some examiners which seems to me to describe conditions about right. The fact that there are 3 grades of licenses issued, and yet no provisions made as to just what field or limit each is entitled to seems ridiculous. There should be a distinction made, or eliminate the second and third and designate them all the same. It is no unusual thing to see engineers of the various grades on the same job, therefore why grade them at all?

As Mr. Rounds says many young men would not study so vigorously after receiving a third class certificate, as there are no more inducements to him to secure a first than a third class so far as conforming to the law is concerned.

The manner of questioning an applicant is sometimes absurd and silly. The examiners will hand you a question that is general which might be answered correctly several different ways, and if asked which is wanted he will very likely point to the question and say there it is, answer it yourself, at least this has happened to the writer. You may give one correct answer, the one that appeals to you most, only to have him give you a cross mark because that is not his way. Again, you may answer it every way possible except one and if that one is his idea of answering it you get a cross mark just the same. This applies even though the examiner may have the answers given him with the list of questions.

I heard an engineer say when he was giving his answer to the question of setting the valves of a duplex pump, he received a cross mark and on asking the examiner how he missed it was told he failed to state how he would get the pistons and rods in the center of the stroke, meaning whether he would move them by his hands, a crowbar or what.

Another point concerning the law was the fraud practiced on several thousand good, honest engineers when they were compelled to undergo another examination with the attendant costs, due to a portion of the law being declared unconstitutional.

In January, 1900, the writer secured a first class certificate by actual examination, and renewed the license each year in the usual manner, until May, 1909, when he was compelled to put up the price and be re-examined for another certificate, with no allowance for what he had paid out for his old certificate, though it had some 7 months to run. The authorities told us our old licenses were no good according to law, but the State of Ohio did not hesitate to realize on the very thing they sold us which was worthless.

If our state legislators are paid good money to pass laws and they do not know enough to pass one that will stand, then there should be provisions made to prevent such proceedings as were inflicted on thousands of engineers last year. Joseph Stewart.

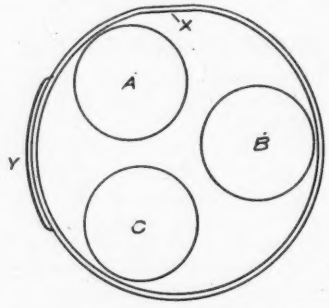
ROLLING AND BEADING A BOILER

MY first experience in engineering was with a small traction ditcher using an upright boiler with 55 2-in. tubes. While washing the boiler I discovered about 4 in. of scale on the crown sheet, although it had run only about a month. Having read considerable, I at once decided to boil it out, which I did by putting in 4 cans of lye and keeping 20 to 40 lb. of steam for 10 hr., then washed the boiler and repeated. This loosened all the scale, which we took out with stiff wire hooks, and the hose.

I thought then my troubles were over for a while, but I found they had just begun. As long as I kept up a good fire and kept going, all was well, but if I stopped and let the fire go down, the water would leak out around most all of the tubes.

I got a roller and beader and got busy but did very little good. I went in bare-headed the first time and then put in a week washing the soot out of my hair. After that I made a cap by tying a knot in each corner of a large handkerchief.

I think I rolled and beaded 6 times, every time I did it a little differently and watched results. The last time I tried the following plan, which was successful: Instead of rolling round and round all the time, I would roll round until the roller would stick at some spots and then if forced would run easy again for a



A TUBE WITH IRREGULAR END

short ways, caused by a thick place in the tube or the hole not being round, the latter would result from the ignorance of the operator, as in this case.

This is illustrated in the sketch, which is exaggerated. It is evident that if there was a thick place in the tube, as at X, the rolls would stick while passing over it. In that case I would roll clear around until this would occur and then roll back and forth letting roller A come up to the bump on one side of roller B come up on the other. One must go by the "feel" and quit when he gets it tight, or the continued rolling will tend to lossen the tube at point X.

If there was a low place in the sheet, as at Y, I would roll around until I got it tight everywhere else, then my sense of touch would tell me that such a place existed, because the tool would turn easier as one of the rollers passed over it. I would place the rollers at this easy place and tap on the pin and roll back and forth, letting the roller come up to the shoulder on either side. One can tell that such a place is there, but, of course, he can't tell which roller is doing the work, and again this easy place might be a thin place in the tube. Of course these things are not always in evidence. If I find any tubes that are the same thickness, and in round holes I roll around until tight, but one must be guided by his sense of touch at all times.

After rolling I use a beader that fits the bead. I always drive a little out and down, taking care that all edges are down tight and leave as smooth a surface as possible exposed to the fire. If the beads are badly cracked or broken off, I take a chisel and trim them before rolling.

Since that time I have fixed 2 boilers that were in bad shape, and after some of the old timers had failed. In both cases one treatment cured. Fred Eckley.

IT OUGHT TO EXPLODE

ON Aug. 3 a boiler exploded in a small sawmill plant about 45 miles west of Germantown, O., instantly killing the owner, who was also the operator, and seriously injuring one other employe.

The boiler was of the locomotive type, 48 by 28-in. firebox, 38-in. shell and 52 2-in. tubes 7 ft. long, and rated about 14 hp., consequently was not under jurisdiction of the license department.

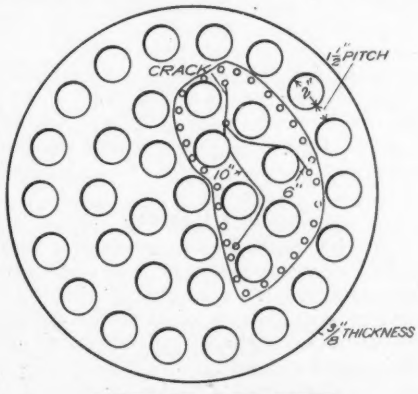
The owner, C. W. Shimp, because of the exemption had usually acted in the capacity of engineer. Though the boiler was said to be old, a careful examination of it after the explosion brought to light no evidence of defects to which failure might be attributed. The rupture occurred in the firebox, tearing through the corner seam on one side and extending upward and through the crown sheet and downward on the opposite side to within 20 in. of the bottom or mud ring.

The piece was completely torn out and measured 3 ft. at the wide end, 10 in. at the narrow end, and about 5 ft. 10 in. long. The metal was 5/16 in. steel and the torn edges of the plate gave evidence of high quality, in well preserved condition, no burning or crystallization being perceptible.

The conditions under which the boiler was operated would seem to furnish ample cause for the explosion; namely, a steam gage and safety valve both of which were inoperative. The pointer of the gage, it is said, moved only slightly under violent vibration, and the safety valve (lever type and connected to the main steam line)—the injured survivor could not say when he had heard it blow last. There was no water glass and only the bottom gage cock was in use; the other 2 being stopped up. Thomas F. Synnet.

MENDING A TUBE SHEET

IN the September number E. P. asks how a cracked tube sheet on a vertical boiler such as shown by sketch can be repaired. I will state that the way they are repaired in Massachusetts is to drill small holes



PATCH ON TUBE SHEET

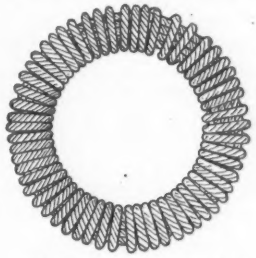
and put in screws at the ends of the cracks to keep them from spreading, then get a piece of plate 0.25 in. thick, in this case, with the tube holes cut out and large enough to go around all that are near the crack. If the surface is rough on top of the boiler a coating of lead will be needed before it can be put on with patch bolts which are pitched equally between the tubes. Thimbles or ferrules are then expanded or beaded in the tube ends to make them tight, or if the tubes are taken out they can be expanded into both head and patch.

This kind of repair is made also in boilers of this type where the heads are burned or blistered, thus instead of putting a new tube head in a sheet is put over the head expanding the tube to it. I might say that the cracks could be repaired by putting copper screws in and hammering them, but I have yet to see a job of this kind that did not have to be patched in the end. D. F. Crowther.

HOME-MADE GASKET

WE have a tank, which has caused a great deal of trouble, but at last our difficulty has been overcome through a little home-made gasket, which, I have reason to believe, could be used on handhole plates just as well.

This is a jacketed tank, and has a hole in the side, which has been the source of our trouble. We have a



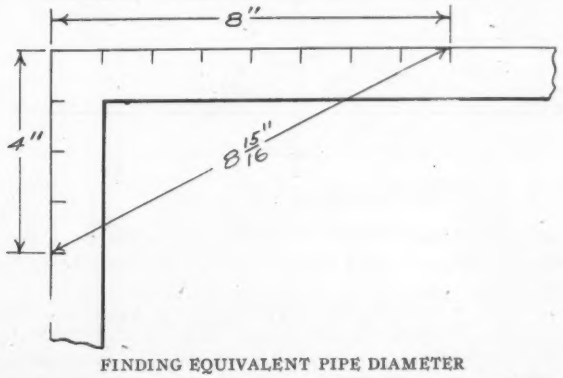
HOME-MADE GASKET

3-in. nipple slipped through the hole, and a locknut inside and out. We have tried almost every kind of packing under these locknuts, but failed to get a tight joint until we made the following gaskets, owing probably to the tank being only 5 ft. in diameter, thereby not having a perfectly flat surface, for the locknut to fit against. We took a good sized piece of lampwick packing, and wound it around a 3-in. nipple, 3 or 4 times, then slipping the packing off of the nipple, we interwound it all around the ring, until we had a solid ring, as shown in the illustration. Of course this was drawn tight instead of loosely, as shown by the drawing.

We slipped one of these rings on each end of the nipple, and using plenty of white lead tightened on the locknuts and all was O. K. Walter C. Edge.

EQUIVALENT PIPES

AN easy way to ascertain the right size of pipe when it is desired to unite 2 pipes into one, is by means of a carpenter's square as shown in the sketch.



FINDING EQUIVALENT PIPE DIAMETER

For example, to find diameter of pipe large enough to take the contents of 2 others, say 4 and 8 in. in diameter; with a rule measure diagonally across, as indicated, which will be about 8 15-16 in.; therefore 9 in. is the nearest pipe which is required. W. O.

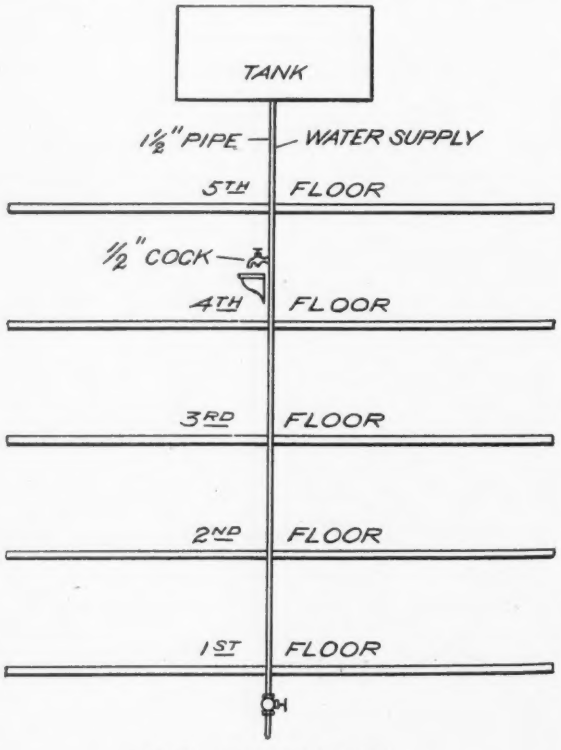
Questions and Answers

To help you when in trouble; give name and address. If quick answer is wanted, enclose a stamp for reply.

Direction of Water Flow

I WISH to submit the following problem for discussion, and also a solution if such is possible. In the building where I am engineer there is a tank situated in the space between the roof of the building and the ceiling of the 5th floor. A 1½-in. pipe supplies the water into the tank through the bottom and the pipe is connected directly to the city water main supply. On the 4th floor there is a ½-in. cock for drawing water for a basin.

The question is, when drawing water from this ½-in. cock will you get water from the pipe coming



ARRANGEMENT OF PIPING

from the main or will the water come down from the tank, or will a certain proportion of water come each way?

The pressure in the supply pipe is equal to the height of the top of the tank, which is about 80 ft. The ½-in. cock is connected to the 1½-in. supply pipe, as shown in the diagram. A mechanical engineer told me, when I open the cock the water will come from the tank, I say it will come up from the supply pipe. I cannot find any means to determine which it is. There are no rules or formula applicable to this case which I can find. The fact that if the pipe is empty and water is turned on it will reach the cock before it comes to the tank, is my stand. H. M. S.

Care of an Idle Boiler

I HAVE 2 horizontal tubular boilers in my plant and only one of them is required to be under steam at any time. The boiler being under steam is worked to about half its steaming capacity and I run it about one month and then alternate to the other boiler and give it a month's run, while the other boiler is shut down for a cleaning out and a rest.

Is it safe and proper to leave a boiler standing idle for a month at a time with water up to the working level and no fire under it? Of course my idea is to have the boiler always ready for starting up, but would it be advisable to shut down the boiler, let out the water and dry it out with a little paper or shaving fire under the grate bars for a few minutes, enough to make the boiler warm? H. M. S.

Voltage Drop on Line

REFERRING to the article "Transmission Line Loss," by H. A. W., on page 584, of September issue of the Practical Engineer, I asume that the motors are at the end of a line one mile long and that the maximum load is 300 amperes; the voltage drop would then be as follows:

50 amperes, 27.4 volts; 100 amperes, 54.9 volts; 150 amperes, 82.3 volts; 200 amperes, 109.8 volts; 250 amperes, 137.2 volts; 300 amperes, 164.7 volts.

In view of the fact that the load is variable it seems to me that an adidtional pair of No. 0000 wires would give all the relief that he needs. This would cost for wire only $192. Cost of erection would depend upon local conditions. W. H. Keller.

Piping a Heater

I HAVE a 450-hp. open feed-water heater, with 8-in. exhaust from one engine and I am installing another engine of the same capacity; would it be practical to connect both exhaust pipes to the same heater, having a valve in each exhaust pipe so as to run either one or both engines at a time? I would only require the exhaust from one engine to the heater. R. W.

A. Your scheme for connecting 2 engines to the same heater will be all right, using a valve in the exhaust of each engine. You should be careful that the piping is so arranged as to take care of expansion, and also should make provision so that either engine may discharge outdoors when the other one is discharging into the heater.

It may be that you will find that the heater will take care of nearly all the steam from both engines, increasing the feed water temperature by just that amount. The only difficulty will be whether the heater has capacity enough to do this without putting too much back pressure on the exhaust line.

ANSWERS TO QUESTIONS FOR STATIONARY ENGINEERS

P. 510 AUGUST ISSUE

By HARRY W. BENTON

A CYLINDER is counterbored to prevent shoulders being worn at the ends of the piston travel. The length of the cylinder bore proper is such that the piston just overtravels the bore at each end; thus it is impossible for the piston to wear a shoulder at each end of the cylinder bore.

2. Because it is practically an impossibility to construct an engine with no clearance space. Engine builders have expended a great deal of time, study and expense, in an effort to reduce the clearance space to the smallest practicable amounts. It would be impossible with the types of valves used today to eliminate the clearance space. Also space is needed to prevent the piston from striking at the ends of the stroke.

3. The combustion chamber is all the space under the boiler, extending from the bridge wall to the back wall of the setting.

4. This is a very broad and important question, and what to do on taking charge will vary according to the type of plant one assumes himself to be taking charge of; also whether the plant has been shut down for some time or is in operation.

Assuming that the plant is in operation, a man's attention should first be turned to the boiler. The general condition of the setting, grates, bridge wall, etc., should be noted, the condition of the boiler shell carefully examined, evidences of leaks and bags being looked for. The location of the water column should be noted and the amount of water carried. All valves in connection with the water column should be tried to make sure that they are in good working condition and that the gage shows the proper water level.

The blowoff pipe should be inspected and the valve opened to make sure that the blowoff pipe is not choked up with dirt. The safety valve and its connections should be examined and the valve gently raised from its seat to make sure that it is in working order. Feed pump, feed lines and valves should be inspected and condition noted; the steam gage should be examined to see if it is working freely, also if the safety valve blows freely at the correct pressure for which it is set, and if the safety valve and gage agree in this respect.

If the inspection shows any defects of sufficient importance, they should be reported to the management. The engine, pumps and accessories should each receive a careful examination; and an opportunity should be made at the earliest possible time to have the boiler thoroughly inspected inside and out, and to have all gages tested and corrected, if necessary, by a boiler inspector if it has not been done recently.

When an engineer takes charge of a plant, he should take every care within his power to obtain a true knowledge of the condition of his plant.

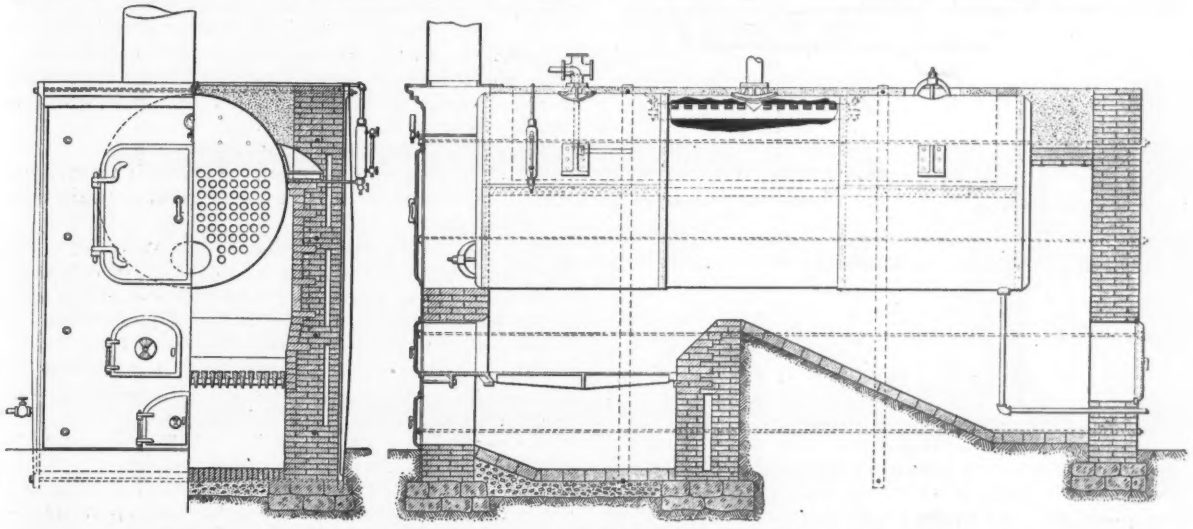


FIG. 1. SECTION OF RETURN TUBULAR BOILER SHOWING THE BRACING OF SETTING

7. A safety valve is a valve connected directly to the steam space of a boiler, and opening out from the boiler; the valve is held to its seat by a force, sufficient to keep the valve closed until the desired pressure is reached in the boiler. Any pressure in excess

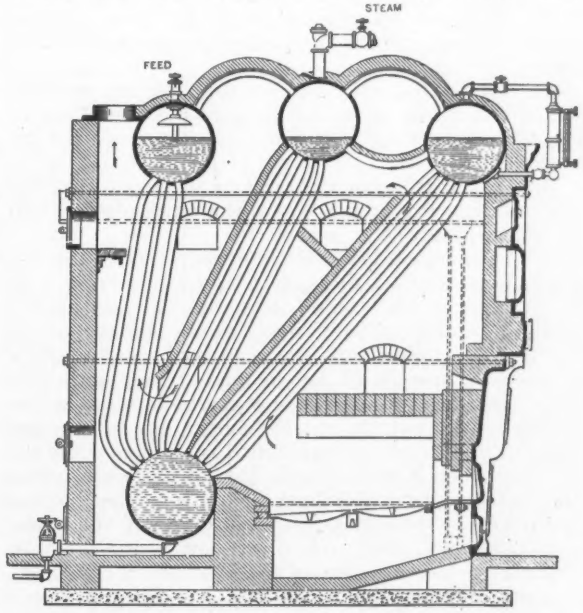


FIG. 2. FURNACE AND SETTING OF WATER-TUBE BOILER

of this forces the valve open, thus allowing the excess pressure to be removed, so that no strain can be set up in the shell above the amount considered safe.

8. Foaming is a condition of great agitation of the water in the boiler. The water rises and falls in the water gage so much that it is almost impossible to locate the water level correctly. This condition is caused by grease or other foreign matter getting into the boiler in sufficient quantity, or by using too much boiler compound in a dirty boiler. It can be checked by blowing down and feeding fresh water, and by checking the fire.

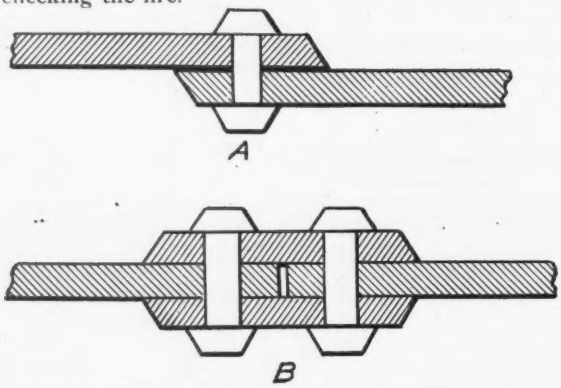


FIG. 3. SECTIONS THROUGH LAP AND BUTT JOINTS

This will check the foaming temporarily, but the cure is to clean out the boiler thoroughly and prevent foreign matter getting into it in future.

Priming is a condition where the water from the boiler is carried over into the engine cylinder. This is caused by working a boiler too hard and by carrying the water too high in the boiler so that the spray from the surface of the water is picked up by the current of steam and carried to the engine. The cure is to carry the water as low as is safe and to use a good dry pipe in the top of the boiler.

9. The top row of tubes, the back head and sides of the shell that become uncovered by water and are below the fire line are the parts first affected by low water.

10. It is a good plan to set the glass so that just as the water level goes out of sight in the bottom of the glass there is still 1 to 2 in. of water above the top of the top row of tubes.

11. By comparing the level of the top of the top row of flues with the position of the water glass, which should be as stated in answer 10.

12. An engine is on the dead center when the piston has reached its full travel in one direction. To find the exact dead center, turn the flywheel around until the crosshead is within a short distance of the end of the stroke; mark the crosshead and the guide so that the crosshead can be placed in exactly this same position again. While the crosshead is in this position, take a tram of any convenient length, and measure the distance from floor to the face of the flywheel, making a mark on the face of the wheel where the tram touches the wheel. Now turn the flywheel until the crosshead passes the dead center and comes into the exact place it has just left; with the tram make a mark on the face of the flywheel as before; bisect the distance between these 2 marks, making a mark exactly midway between them. Turn the flywheel back until this center mark comes exactly in line with the end of the tram and the engine will be on the exact dead center.

13. In case of overpressure on the boiler, every effort must be turned to reducing the pressure gradually to the safety valve pop pressure.

The fire should either be drawn or covered with ash to kill its heat; all dampers, ash pit and furnace doors should be closed. The engines should be left running and the water level kept steady until the pressure is worked down just below the pressure at which the safety valve should blow; then an effort should be made to open the safety valve. In a case like this the safety valve should not be touched while the pressure is much above the pop pressure, because a little jar might cause it to open and, if it did, the sudden liberation of the excess pressure might cause a rupture of some part of the boiler or even an explosion.

14. The pressure which a boiler can stand is found as follows: Twice the tensile strength of the metal times the thickness times the joint efficiency divided by the diameter and by the factor of safety which is usually taken as 5. In this case,

$2\times60{,}000\times\frac{3}{8}\times0.75\div(48\times5)=140.7$ lb.

15. The longitudinal seams are double riveted because they are subjected to a much greater strain than the girth seams.

16. Lap is the amount that a slide valve laps over the edges of the steam ports when the valve is exactly in midtravel; the amount lapping over the steam edge of the port is called steam lap, that lapping over the exhaust edge of the port is called exhaust lap.

As applied to Corliss valves, lap is the amount the working edge of the valve laps over the working edge of the port when the valve is closed.

Lead, is the distance that a steam valve is open when the piston is at the end of the stroke.

17. The number of valves in a duplex pump depends upon the ideas of the designer and upon the service the pump is intended for; but any duplex pump must have at least 8 valves in the water end; 4 of these are suction and 4 of them are discharge valves.

18. A lap joint is one in which the plates to be joined are lapped over each other enough to allow room for the rivets as at A, Fig. 3.

19. A butt joint is one in which the ends of the plate are placed together; and a strip laid over the joint, on each side of the plate, the rivets passing through the 3 thicknesses as at B, Fig. 3.

20. The butt joint is generally considered much superior to the lap joint.

21. Clearance is the space between the piston and the end of the cylinder when the piston is on the dead center, plus the contents of the steam ports leading to this end of the cylinder.

22. If there were no lost motion between the valves and the jam nuts on the valve stems of a duplex pump the pump would not take a full stroke, and under some conditions would not run at all.

23. There is no expansion of steam in the cylinder of a duplex pump. In an engine cylinder, the period of expansion is the part of the piston stroke completed after the valve has closed the steam port, so that the piston is urged forward by the expansive force of the steam.

24. The flywheel is to equalize the variations of power developed by the engine cylinder so that the rotative speed of the shaft is uniform; this property of the flywheel also assists an engine in passing the dead centers.

25. The water would rise in the glass until the glass was full of water; thus it would appear as if the boiler were full of water.

CONTINUOUS OPERATIONS

MULTIPLYING AND DIVIDING COMBINED

AS to last month's examples for practice: 1. For 273×18.3, set 1 of B at 273 on A and over 183 on B find 5025 lb. on A.

2. For 1100×0.7854, set 1 on B to 11 on A and over 7854 on B find 859 on A. As 0.8 of 11,000 would be 8800, the answer must be 8590 lb.

3. To get amperes with watts and volts given, divide the number of watts by the number of volts. For 229,000÷525, set 525 on B at 229 on A and over 1 on B find 438 on A. As 200,000÷500=400, the answer is 438 amperes.

4. The water horsepower will be 11,300×73÷33,000 and to get the efficiency, we divide the result of this operation by 32.2 or changing the order of the operations gives 11,300÷33,000×73÷32.2. Set 33 on B under 113 on A, and over 1 on B find 3425 on A.

This is to be multiplied by 73, so we find over 73 on B 25 on A, and as this is to be divided by 32.2, we bring 322 on B under it and over 1 on A is found 78. The easiest way to find the position of the decimal point is to write down the operations with the nearest approximate numbers having all ciphers but the first figure and cancel out as follows:

$$\frac{10{,}000 \times 70}{30{,}000 \times 30} = \frac{7}{9}$$

and it is evident that the result of the computation is somewhat under 1. It will then be 0.78, or 78 per cent efficiency.

Combined Multiplication and Division

THE last problem has led us into the combination of multiplication and division, and the continuous method of calculating which is one of the chief time savers in the use of the slide rule. We saw that in a division, the quotient is found over the 1 of the scale, and the next multiplication is performed by bringing the 1 of the scale to that quotient. It is evident therefore that the scale is already in position to make the multiplication, so that we can go ahead without a new setting.

All that we require to save half of the settings is to make a division and a multiplication alternately, starting with a division. To save time then, it is best to get all the divisions and multiplications of a problem indicated before starting to use the rule. When starting the operation of the rule it pays to see what will be the best division to take first, as work can often be saved by so doing.

Horsepower of Engine

IN the case of the ordinary rule for the horsepower of a steam engine, the work is greatly simplified by the use of a little care in the method of going at the work. The expression is:

$$\text{Horsepower} = \frac{\text{m.e.p.} \times \text{stroke} \times \text{area} \times \text{r.p.m.} \times 2}{33{,}000}$$

the m.e.p. being in pounds pressure per square inch, the stroke in feet and the area of the piston in square inches. Take the case of the low-pressure cylinder of a compound engine having a m.e.p. of 18.5 lb. a cylinder 30 by 60 in. and at 50 r.p.m.; the rule gives the area of the piston direct from the diameter by means of one of the key letters, so that it pays to start with the area first. Then set G to the mark in the upper keyhole, and bring the mark on the runner to 30 on scale C; the area of the piston is found at the upper end of the index mark on scale A. As this is one number in the numerator of the expression, we bring 33 on scale B under the index mark on the runner, then move the runner to 18.5 as that is the next multiplier. Then move 1 on the slide, scale B, to the mark on the runner, and the runner to 5; then 1 on the slide to runner and runner to 50; then 1 on slide to runner and runner to 2 and above the mark on the runner find 1975 on scale A which, by approximate cancellation as before, we find to be 197.5 hp.

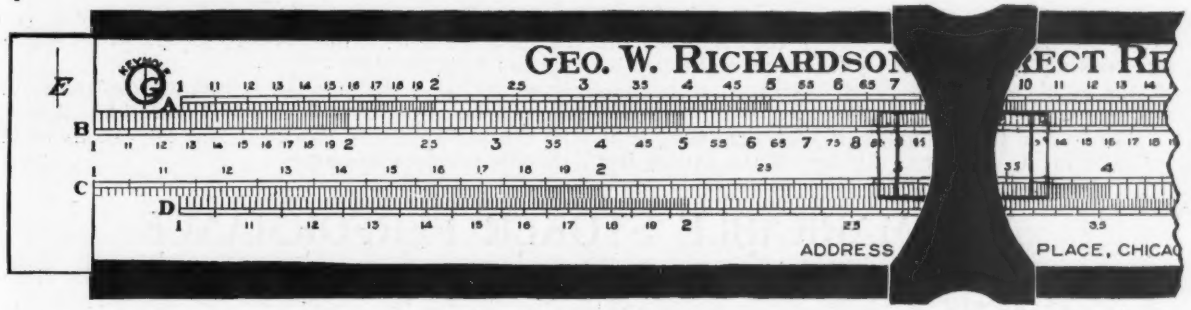


FIG. 1. SETTING TO FIND AREAS OF CIRCLES FROM DIAMETERS BY USE OF G

Boiler Horsepower

LET it be required to find the rated horsepower of a 48-in. return tubular boiler 16 ft. long with 46 3-in. tubes allowing 12 sq. ft. to the horsepower. It is the custom to consider half of the shell, all the tube surface and the part of the back head not taken out by tubes as active, hence, we have to calculate these areas in square feet and divide the total amount by 12.

To get the area of the shell, we must have the circumference in feet and multiply it by the length, and here comes in another of the key letters of the rule. Setting j in the lower keyhole the circumference of any circle will be found on scale A opposite the diameter on B. In the present case, as the diameter is 4 ft. (=48 in.) the circumference will be 12.6. This is to be multiplied by the length and divided by 2 to get half the area; so taking the division first, bring 2 on B to the runner, and then move the runner to 16 on B and over the mark find 100 sq. ft.

To get the area of the tubes, it is more convenient to find first the diameter in feet by dividing 3 by 12, which gives 0.25 ft. Then setting slide at j bring the runner to 25 on B, and continue the multiplication of the circumference of the tube by 16, the length, and 46, the number of tubes, and the result is 600 sq. ft.

Area of the back head will be the area of the whole head less the areas of the tube ends. By the same setting as in Fig. 1 the area of the head is 12.6 sq. ft. and as the diameter of a tube is 0.25 ft. the area from the same setting will be 0.0491 sq. ft. which, multiplied by 46, the number of tubes, gives 2.26 sq. ft. to be subtracted from 12.6, leaving 10.34 sq. ft.

The sum of the 3 amounts is then 100+600+10.34 =710.34 sq. ft. Dividing this by 12, the square feet allowed to a horsepower gives 59.2 as the rated horsepower of the boiler.

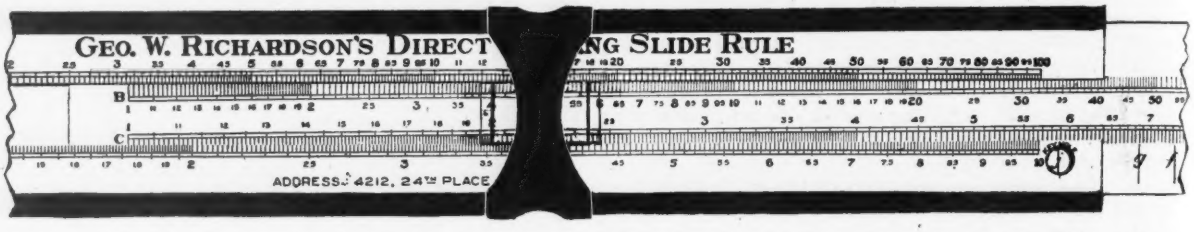


FIG. 2. SETTING TO FIND THE CIRCUMFERENCE OF CIRCLES FROM THE DIAMETER BY USE OF j

Practice Problems

1. How many gallons of water in a cylinder tank 6 ft. diameter by 9 ft. long?

2. How many square feet to paint on a stack 54 in. diameter and 63 ft. high?

3. What is the ratio of the cylinder volumes in a compound engine with cylinders 12 and 20 in. diameter and 24 in. stroke?

4. What is the per cent of clearance in the cylinders of the engine of problem 3 if it takes 1.2 gallons to fill the high-pressure clearance and 4.6 gallons to fill the low-pressure clearance?

A REMARKABLE STOKER PERFORMANCE

TESTS of performance and records recently made by an installation of the Jones Under-Feed Stoker with new additions for the purpose of making it self-cleaning are so remarkable that if it were not for the proof presented and the high standing of the company which vouches for these results one would hesitate to accept them. As it is, there can be no conclusion reached except that the performance is a step forward in boiler practice toward the end of larger performances for a given installation and, therefore, greater efficiency in the production of power.

The manufacturer of the Jones Under-Feed Stoker, the Under-Feed Stoker Co. of America, has realized for a long time the desirability of mechanically cleaning fires, but has realized also the great chance for waste of fuel by mechanical cleaning and has, therefore, been working along the lines of devising a stoker that could be mechanically cleaned without carrying an unreasonable percentage of combustible matter into the ash. In order to keep a fire clean by mechanical means, care must be taken that the cleaning is in proportion to the burning of fuel or the loss of combustible may produce a greater cost than that of cleaning of fires by hand, and the hand cleaning where the stokers are properly arranged will usually be but a small item in the labor cost.

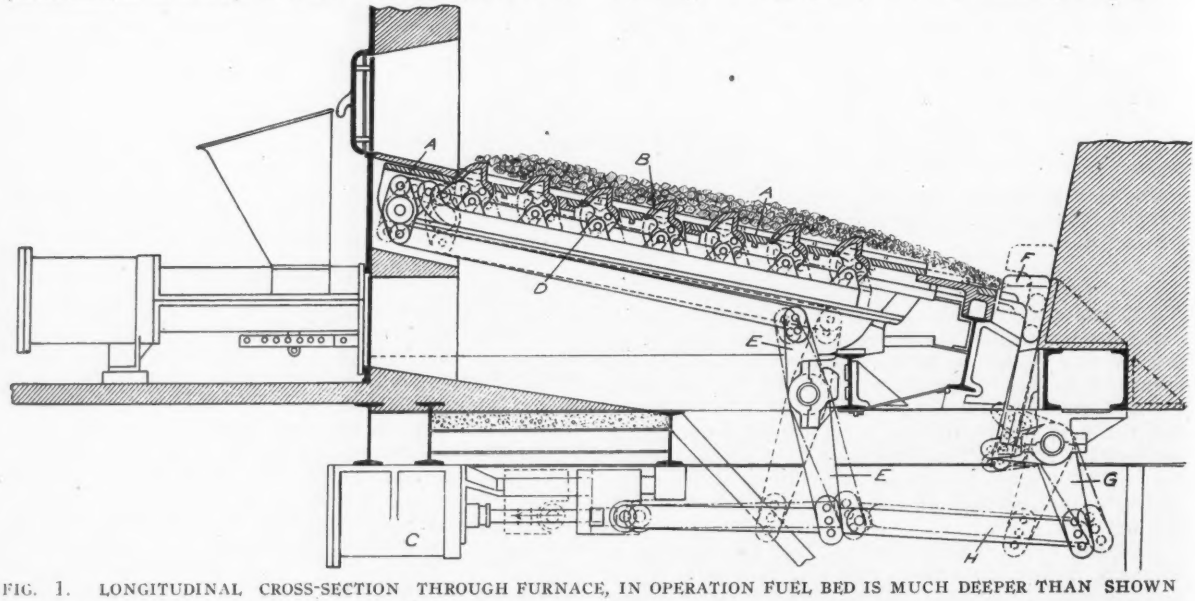


FIG. 1. LONGITUDINAL CROSS-SECTION THROUGH FURNACE, IN OPERATION FUEL BED IS MUCH DEEPER THAN SHOWN

In the design of the new Jones, which its manufac-

turer describes as a high duty self-cleaning automatic mechanical stoker, there has been kept in mind not only the mechanical cleaning of the fires but the possibility of increased capacity as well, due to this mechanical cleaning, and also the maintenance of smokeless combustion.

To give an idea of the results secured, 2 of these stokers placed in operation about the first of May of this year, under a Heine safety water-tube boiler which at 10 sq. ft. of heating surface per horsepower had a rating of 360 hp., have been in constant operation night and day since installation. The fuel used has been mainly a low grade coal from Iowa, Illinois and Indiana. It has not been possible to determine the fuel burning capacity of these furnaces because the boiler surface could not absorb heat fast enough, but in a furnace 9 ft. 1 in. wide by 6 ft. 10 in. long there have been consumed to commercially complete combustion 3340 lb. of coal an hour, which is at the rate of 53 lb. of coal per square foot of furnace surface per hour.

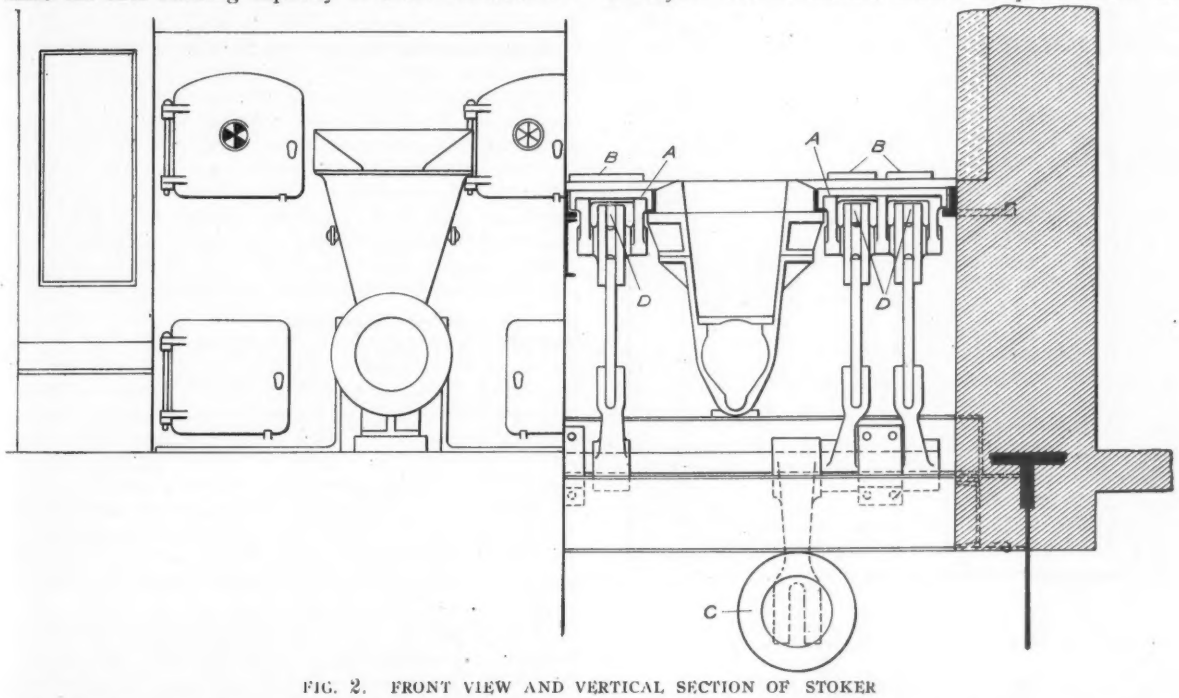


FIG. 2. FRONT VIEW AND VERTICAL SECTION OF STOKER

Spite of this high rate of combustion all parts of the stoker both inside and out are now in perfect condition, no repairs to the stokers proper have been made and none are now necessary. When the equipment was installed, owing to an improper reading of blue prints furnished, the self-cleaning device was so rigidly installed that no clearance was possible, and 2 levers controlling it were broken and have been replaced but this did not require discontinuance of operation of the stokers.

Such a record is reasonable evidence that repair bills will be low. With 2 of these self-cleaning stokers in a water leg furnace 5 ft. 6 in. wide by 8 ft. long, smokeless consumption of 7000 lb. bituminous coal an hour has been obtained, being approximately 160 lb. per sq. ft. of furnace surface per hour. Experiments made with the first mentioned boiler to ascertain the maximum fuel consumption under that boiler and lasting from 3 to 5 hr. showed maximum combustion obtained of 6600 lb. an hour or 105 lb. per sq. ft. of furnace surface but this was not the limit of the stoker, it was the limit of the boiler capacity to absorb heat.

In the handling of the Iowa coals containing high sulphur, iron and silica, there was no difficulty with the handling of the ash which frequently with some types of furnace forms a heavy clinker. The refuse dropping into the ashpits consisted of fine particles seldom over an inch square and in such condition that they could readily be carried away by any conveyor which might be installed.

The plant is arranged so that coal is delivered from spouts to the hoppers of the stokers, the fires are cleaned automatically, the ash is carried away by conveyors and no manual labor is required after the fires are once started. As to the furnace proper, the stoker consists of the Jones Under-Feed pure and simple, with automatic system of control of fuel and air supply. The retort is made longer than in the standard stoker, with the tuyere area greater and the blocks of greater height, therefore containing greater air outlet. This area is, therefore, increased fully 200 per cent. Due to this increased area the high fuel burning can be obtained with a materially reduced air pressure, as is shown by the test reports.

The fuel feeding capacity of the stoker is unlimited and more fuel can be conveyed to the furnace than can be safely burned in a furnace of the length and width which one of the stokers will properly serve. In installing one of these stokers, as the rate of combustion is so high the ordinary basing of chimney capacity on the horsepower boiler capacity will not be satisfactory. The chimney must be based on the fuel consumption obtained, as otherwise there will be no means of carrying away the products of combustion or conveying them to the heating surfaces of the boiler.

Details of the Stoker

TAKING up now the new Jones stoker in detail, the depth of retort at the forward end is over double that of the standard stoker and this depth gradually

decreases towards the rear end of the stoker until at the back end it is practically the same as for the standard stoker, the bottom of the retort being set horizontal and the top sloping toward the back.

The parts of the self-cleaning device outside the furnace proper are the same as for the standard stoker. An auxiliary cylinder is provided to operate the self-cleaning mechanism, and in the figure shown is located beneath the floor, but this cylinder may be placed on the floor line at any accessible point. Its operation is controlled by a separate Cole automatic attachment, the same device that is used to control the fuel air supply of the stoker proper, the air also being automatically controlled and proportioned.

In place of solid dead plates sectional plates are used, each section locking into its mate. These plates

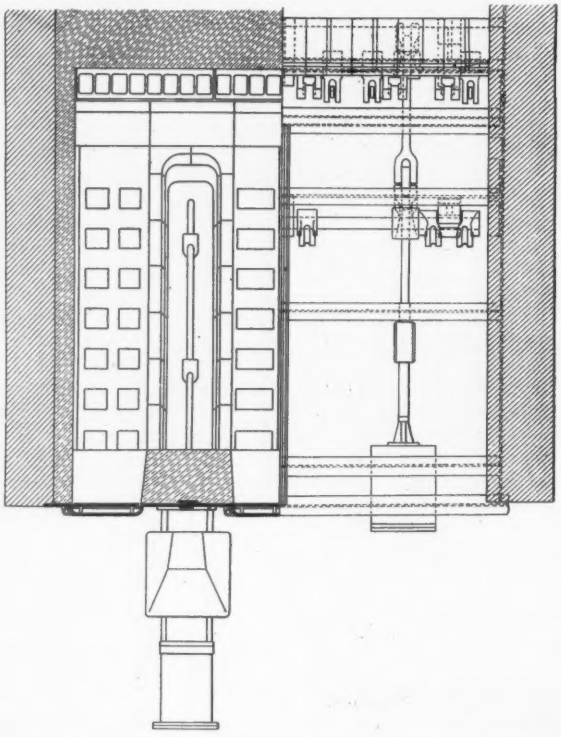


FIG. 3. PLAN OF STOKER AND OPERATING DEVICE

have longitudinal motion varying from 2 up to 6 in. or more if desired, and the plates have rectangular openings for receiving dogs B located at approximately 9 in. apart lengthwise of the plates.

Beneath each dead plate, actuated by the auxiliary cylinder C, is a bar D which connects the lower portion of the dogs together, thus giving a movement of all dogs in the dead plates in unison with the movement of the dead plates themselves after the dogs have reached their maximum height. After the dogs rise facing towards the bridge wall the plates also move toward the bridge wall, thus carrying the entire mass of refuse toward the back end of the furnace. Each connecting bar, B, is moved by the lever, E, underneath so that these levers necessarily operate in unison.

At the rear end of the stoker is a refuse breaker, F, which also operates in unison with the dogs and the dead plates, the breaker rising as the dogs move upward and the dead plates moving forward and descending as the dogs fall and the dead plates return to their first position. In this way the refuse breaker cuts off that part of the refuse which projects beyond the dead plates, breaking it up and forcing it downward into the ashpit. As the edge of the refuse breaker is on a slight angle with the lower cutting edge of the dead plate, a shearing effect is produced.

Following the levers it will be seen that the movement of the refuse breaker, F, is controlled by lever G, operated by the connecting bar H, which connecting bar also operates the lever E from the auxiliary cylinder C. When dead plates are at rest the backs of the dogs are flat with the dead plate surface. The normal position of the refuse breaker is down with its top about level with the rear dead plate.

Experience has shown that the best results are produced by a comparatively frequent movement of the complete self-cleaning attachment, thus avoiding accumulation of refuse in the furnace proper. The rapidity of operation can be regulated at will by means of the Cole automatic attachment. Also frequent agitation of the fuel in the retort by means of introducing fresh fuel and of the material on the dead plates by their motion gives practically perfect combustion.

The results are the test of the action of any apparatus and the following tests are vouched for by the Under-Feed Stoker Co., which stands ready to prove these results at any time to anyone interested in the performance of these stokers. One test made on July 28, 1910, for 5 hr. on a furnace installed under a 350-hp. Heine boiler, using coal from Enterprise, Iowa, carried a steam pressure of 143.6 lb., blast gage 1.65 in. of water, furnace draft 0.194 in., stack draft 0.65 in., feed water was furnished at a temperature of 75 deg. F., and the temperature in the uptake was 628 deg. F.

During the 5 hr. the total coal consumed was 16,698 lb. or 3339.6 lb. per hour. As 2 stokers were used this made 1669.8 lb. per hour per stoker. Total water evaporated was 123,314 lb., the factor of evaporation being 1.1912, giving an equivalent evaporation from and at 212 deg. of 146,881 lb. The actual evaporation was, therefore, 7.38 lb. per pound of coal and the equivalent evaporation from and at 212, 8.79 lb. per pound of coal. The horsepower developed was 851 or 236 per cent of the builders' rating, while the efficiency was 70.7 per cent.

The coal showed an analysis of 42.89 volatile combustible, 41.78 fixed carbon, 8.01 moisture and 7.32 ash, all being percentages. The heat value per pound was 11,996 B.t.u. Analysis of the refuse showed 5.98 per cent volatile, 9.61 fixed carbon, 0 moisture, and 84.41 ash.

A second test made on Aug. 19 verified most remakably the results of the first test. In this, which was made on the same installation and lasted for 5 hr., boiler pressure was carried at 151 lb., blast gage at 1.8 in., furnace draft at 0.13 in., stack draft 0.6 in., feed water was furnished at a temperature of 74 deg. F. The boiler was not forced as hard as in the previous test, since the owners of the plant did not wish to have it operated at such high capacity. The total coal used was 12,000 lb. or 2400 lb. an hour, the total water evaporated being 95,288.4 lb., with a factor of evaporation 1.1923. This gave an equivalent evaporation total of 113,621 lb. or 7.94 lb. actual evaporation per pound of coal and 9.468 lb. equivalent evaporation from and at 212 deg. per pound of coal. The total horsepower developed was 658, which is 183 per cent of the builders' rating, and the efficiency secured was 76.2.

Comment on these figures seems hardly necessary further than what has already been said, but as the stokers and furnaces were not forced to their full capacity, the question comes naturally to mind, what could have been done if the boilers had been forced to the highest possible limit? These tests confirm the fact which has been repeatedly established that our limit of boiler performance in the past has been in the furnace and not in the boiler, and the new design of the Jones Under-Feed Stoker has brought it apparently to the position where the limit of capacity is the other way out.

A NOVEL CONDENSER

JET condensers are as a rule much alike, but in the Type C brought out by the Allis-Chalmers Co. are embodied several distinctly different features. It is designed so that all condensing apparatus except piping can be placed beneath the foundations of a steam turbine between the columns, so that the turbines may be placed as near together as desired, thus cutting down the floor space required.

In shape, the condenser head is cylindrical, with exhaust opening connected directly to expansion joint. This joint is in turn connected to the exhaust opening of the turbine, an arrangement which eliminates

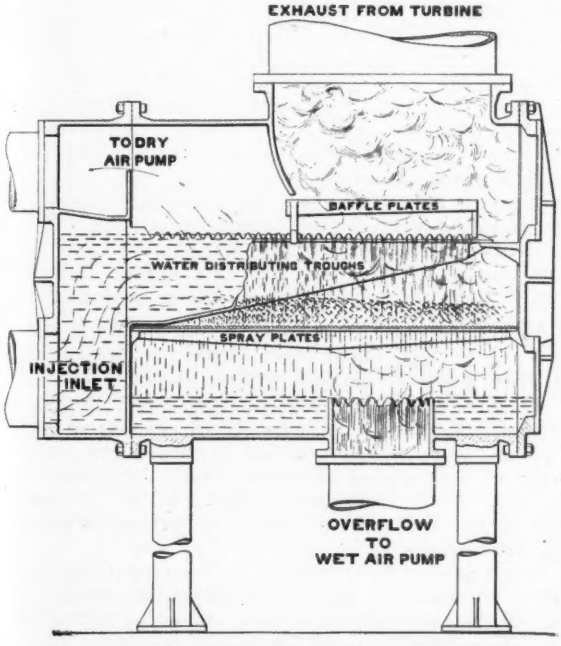


FIG. 1. LONGITUDINAL SECTION OF CONDENSER

all exhaust piping and limits the joints to the 2 necessary for the expansion connection. This reduces air leakage and gives higher vacuum.

The condenser is so arranged that vacuum can be formed or recovered with full load on the engine or turbine without stop valve in the main exhaust pipe and without auxiliary forced injection. Also the close connection of the condenser to the turbine avoids loss of vacuum from elbows and piping. Steam travels only 3 ft. from the exhaust nozzle of the turbines before coming in contact with water from the condenser, so that there is no appreciable difference in vacuum between the condenser and the turbine exhaust.

Figure 1 shows the longitudinal section of the condenser with exhaust from the turbine overflow to the air pump, injection inlet and connection for the dry air pump. As it enters steam passes downward between baffle plates and meets at once sheets of water from the distributing troughs, and these sheets of water fall upon spray plates located below and are

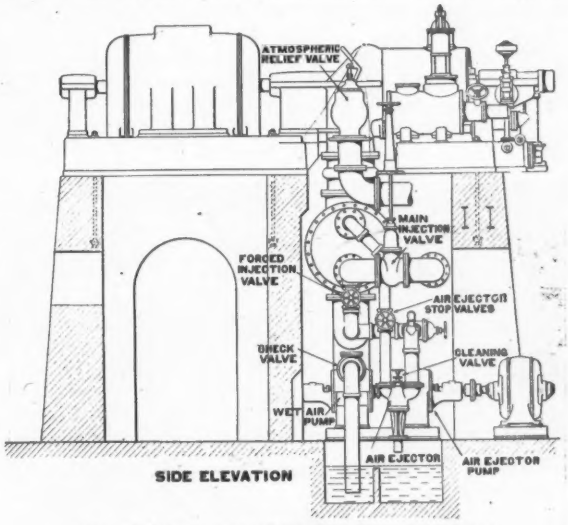


FIG. 2. SIDE ELEVATIONS OF CONDENSING EQUIPMENT

broken into a heavy rain with which the steam mixes and is instantly condensed. The overflow extends some distance above the condenser so that sediment

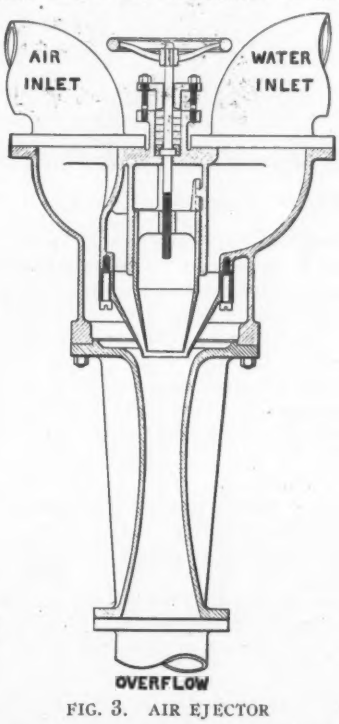


FIG. 3. AIR EJECTOR

may be deposited on the bottom of the shell and cleaned out through the hand-hole opening.

If for any cause the water pumps should stop, the check valve in the discharge of the main pump will immediately close and water flowing through the sec-

ond pump to the air ejector nozzle will stop so that air will rush through the suction line to the condenser, thus breaking vacuum. The condenser cannot, therefore, flood, and water cannot back up into the exhaust line of the turbine. The quantity of injection water is controlled by a main injection valve in the pipe leading to the inlet. As seen in the cross section the distributing throughs have notched edges to break up the sheet of water.

As shown in Fig. 2, both the wet-air pump and the secondary air pump to supply water for the ejector are driven by a single motor on the same shaft, and in the arrangement shown the condensing water comes to the condenser by suction from a cold well

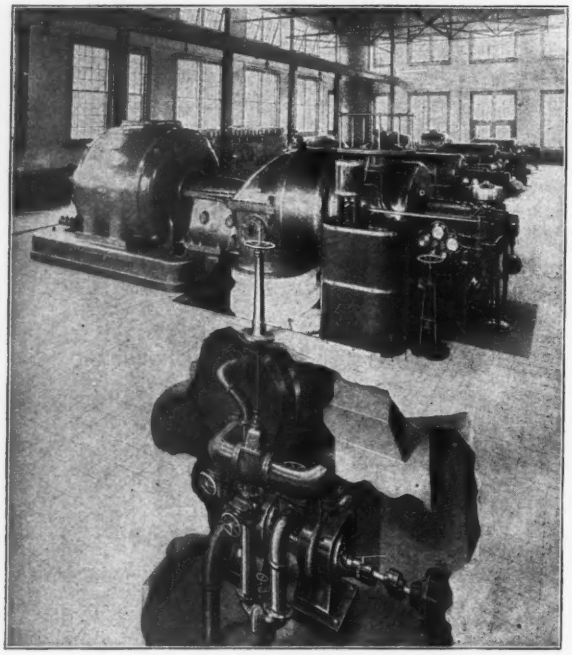


FIG. 4. TYPICAL INSTALLATION OF TYPE C JET CONDENSER

located in the floor of the basement. In all cases water supply should be brought by gravity to a point as near the condenser connections as possible, and care should be taken in installing the injection water piping to have it short and direct; also velocity of water entering the mouth of the pipe should be reduced as much as possible, and it is best accomplished by making the mouth bell shaped and twice the diameter of the pipe. The pumps used are of centrifugal type, arranged to be primed by the use of a steam injector. In the air ejector valve shown in Fig. 3 the air inlet is so arranged that it comes in contact on both sides with the hollow stream of water.

The only point which might cause trouble is the narrow passage for the stream of water and, if this should become clogged, the inner nozzle can be drawn back by turning the hand wheel, allowing the foreign material to pass out when the nozzle can be screwed back into position.

STRENGTH OF ROPE is very irregular, much depending upon the quality of the fiber used and the solidity in which the rope is put together but a safe rule is to multiply the square of the circumference in inches by 8 and the product will be the number of net 100 lb. required to break the rope.

LUBRICATION OF WIRE ROPE

IN the American Wire Rope News for May, published by the American Steel & Wire Co., are shown some interesting illustrations of the effect of using wire rope without lubrication. Corrosion is particularly noticeable in the inside wires of the strands from the failure of improper lubricants to work inside the rope. These inside wires carry the greater part of the strain after the outside wires have worn and commenced to break up, so that if they corrode the life of the rope is lessened.

Other illustrations show the appearance of a wire rope which has been well lubricated during the entire time of its service. The unlubricated rope shows irregular twists and breaking of the strands as well as corrosion, while the strand from the well lubricated rope has about the same appearance as when new and the rope maintains its evenness of structure, only the outer wires being somewhat worn.

It is unreasonable to expect a protective coating to act as a lubricant or a lubricant to act as an efficient coating. Neither will the same lubricant do on slow speed rope under heavy loads and on high speed under light loads. Many ropes fail because of the complete corrosion of the inside wires of the strand, while the outside wires are apparently in good condition. Lubricants should penetrate the rope, and no great help can be expected from the hemp center. While this may have been thoroughly saturated in the beginning, the lubricant will be squeezed out of it during the process of rope making and the early days of use so that outside lubrication must be depended upon. Neither is a lubricant which will run out of the rope easily under the action of the hot sun, leaving it dry after a few days, of much value.

There is no real necessity for greasing a rope every day if a properly selected compound is used, but the lubricant must have staying power even at fairly high temperatures. Wear on the rope comes from the drums and rollers and also from the sliding of the strands on each other.

The Proper Shield

PROPER protection should form a cover, not only for the outside, but also for the inside. It should not form a hollow shell capable of keeping in moisture and drippings, nor should it harden quickly and break off. It should be impervious to moisture and remain plastic for a considerable time, yet should be sufficiently fluid when applied to penetrate around the inside wires.

Experiments have worked out 4 preparations. The first is a moderately heavy bodied compound and lubricant to be applied warm and act as agent against dampness, moisture and fine water. It is for use on hoisting rope, running at high speeds where heavy service is demanded, on shaft and slope ropes, conveyors, transmission and haulage. For use on crane shovel, dredge and derrick ropes a heavy bodied grease containing a high percentage of pure graphite is recommended. This can be applied less frequently than the first one and is particularly effective on slow speed ropes under heavy loads. It is to be applied cold and is little affected by changes in temperature.

A third compound is a heavy protective coating to be applied cold and which forms an even shield against moisture, salt water, gases, etc. It is particularly suitable for ship rigging, derrick guides, smoke stack guides, and is dark in color. The fourth is a

light bodied fluid with a slight odor and having high lubricating value. It is designed particularly for elevator ropes, applied cold in small quantities with a brush. In all cases the particular usage to which a wire rope is submitted should be known before the lubricant is bought or applied, because if the lubricant is not adapted to the work it will not only injure the rope but disgust the user.

LEADERS IN POWER PLANT ENGINEERING

W. E. SANDERS; A MAN WHO HAS MADE HIS MARC (O)

WIDE experience in many lines fits a man to take a broad view of his problems; and such experience comes from contact with men as much as with things. In this respect Mr. Sanders has had large opportunities which his career proves have been put to good use.

Starting from the scientific side of engineering he has known how to apply that knowledge to practical uses for the benefit of the man who runs things, and his wide circle of friends among operating engineers have recognized his sincere interest in their progress and welfare.

Starting with a preparatory course at University of Michigan, which was interspersed with side trips to the School of Experience and the University of Hard Knocks, the trail which he followed led to Yale where the course in engineering was absorbed, the process being completed in 1894.

Teaching of the sciences occupied the next 6 years, and a graduate course in engineering combined with teaching and experimental work on steam machinery resulted in a degree of Mechanical Engineering in 1903.

But Sanders isn't the kind which thinks that degrees make the man, so he got into overalls and started to hunt trouble among the engines of the U. S. Steel works at Loraine. He found it. And he conquered it. He staid with those engines until they would eat out of his hand and he set them and adjusted them and packed them until they were noise proof and steam tight. Then having nothing difficult, therefore interesting, to do he hiked to Pittsburg and pitched camp at the Schoenberger Works where he was elected chief engineer and master mechanic.

It is quite evident that even the most omnivorous seeker for difficulty would find a meal in installing and rebuilding 5 engines of 300 to 400 hp. with the blowing tubs for feeding blast furnaces, and even Mr. Sanders got his fill.

He was, therefore, ready to accept a position promising a less strenuous existence when the offer came to take the Assistant Professorship of Machine Design at Pennsylvania State College which he held until 1905.

Then the Mechanical Rubber Co., seeking someone to analyze and solve the problems in its packing department and to put his results instructively before others, found Professor Sanders, lifted him from his professional chair and sat him down at the desk of manager of that packing department, handing him as a basis to work on a square spiral and a red sheet.

Said he, "Why is a packing?" And his engine experience answered why and also what a real packing must do. And so he analyzed the work of packings, and classified them according to the service to be rendered and again according to how they act. Then he set at devising and constructing a complete line to meet scientifically all needs. Marco packings are the result—including the wound wedge which is one of his inventions, the combination flax with duck on 3 sides, the trade mark name, which he evolved and the sales force which he organized.

Part of the selling work has been lecturing before salesmen and engineers' associations on just those principles and classifications that his study of the packing problem discovered.

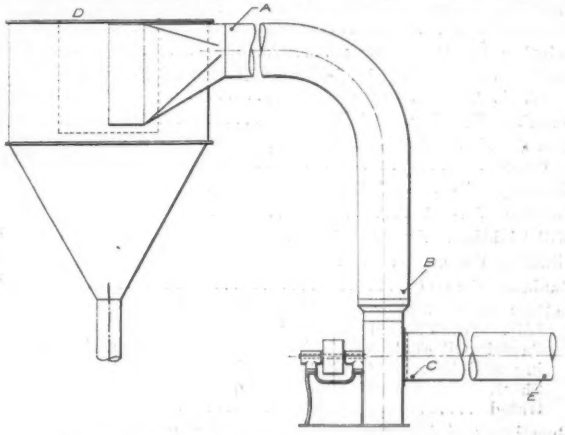
Also he has written for Practical Engineer and other papers on the history, principles, construction, manufacture, and use and abuse of packings, thus adding largely to the knowledge on this important subject.

Whatever his restless spirit of investigation may lead him to take up in future, is quite certain to get turned inside out and bottom side up until he knows all about its "innards"; and then it will get fixed up on a scientifically as well as practically correct basis.

TROUBLE WITH A CYCLONE

IN A cyclone in the eastern part of the country the fan is 55 in. diameter, runs at 1500 r.p.m. and the diameter of the cyclone is 4 ft. 6 in.; the diameter of the outlet 11 in. by 20 in. The pressures and vacuums in the system at the points shown on the illustration were as follows:

At B the pressure blew all the water out of an 8 in. U tube. At C the vacuum was 6 in.; at E 4 in., and at



DRAFT MEASUREMENTS ON CYCLONE SYSTEM

the end of the line 3.5 in. The diameter of pipe C is 18 in. The fan is motor driven, the capacity of the motor being 30 hp.

The report on this job by our cyclone expert is as follows:

"The wheel would be 33 in. in diameter, and at 1500 r.p.m. would have a capacity of 13,000 cu. ft. This ought to give a 10-in. vacuum so that there is a loss of 4 in., according to figures given. To correct the system the cyclone should be 8 ft. in diameter, the outlet 40 in. and the inlet 9 by 40 in. This should take off the back pressure so that the fan instead of using 30 hp. would require but 17. I think that the pipe from fan to cyclone is smaller than is called for by the size of the fan, and the handling of the air from a fan of this size."

ALLIS-CHALMERS MACHINERY

IN the article on the High Falls, Wis., plant published in the September issue, by an oversight the fact was omitted that generators, turbines and exciter units for the plant were furnished by the Allis-Chalmers Co. and that the installation work was done by them.

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WHY EXHIBITIONS?

Looking at the money invested in the articles displayed, the cost of arranging, decorations, signs and transportation and the expenditure in time and traveling expense of those who go to see and to have their wares seen, the question will come to every thinking man, "What is the reason and does it pay? If so, how?"

For the exhibitor, the object is to increase sales. It is concentrated and applied advertising. For the exhibitee it is to increase his knowledge. It is collective, practical study. Instruction is the aim of both, the one to give, the other to get.

Until the exhibitor gets the attention of his possible listener, he cannot instruct him. Unless the seeker for knowledge "keeps his eyes and ears open," his attention on duty, he will miss the things that he wants to see. Either exhibitor or visitor who lets amusement be his sole aim, fails entirely of his object.

CUTTING COSTS

All about us we hear the cry about "increased cost of living" and volumes are published on reducing cost of manufacture. Comparing the way we live with that of our grandfathers and the why of increased cost of living is evident; better quality. We insist on more comforts, more safeguards, more leisure, more luxuries; the rich seek to be richer in order to induge in the costly pleasures now in fashion, and the man of moderate means follows their lead.

To reduce cost of living the first thing is to realize that the things best worth while in necessaries and in pleasures are usually inexpensive. Simple, comfortable clothing, nourishing, digestible food, good books, friendly companionship are not costly. Making a show and chasing excitement are the things that waste time, income and strength, the 3 things that in all manufacturing we seek to save.

In operating a plant, the same things are true. All finish which helps toward cleanliness, efficiency, durability will cut down cost of operation. All apparatus, ornamentation or finish put in for show increases labor of running and cost of upkeep.

Keeping things clean and shipshape pays. Anything that adds to the work of doing so doesn't, and should be "cut out" as soon as possible.

OFF DUTY

The Debt to Science

We all know the debt that engineering owes to applied science, for engineering is applied science. But often the mother of all progress, science for its own sake, for the sake of knowing Nature's secrets, is belittled even by those who owe most to her.

For instance, it was long the fashion for self styled "practical" men to pooh at chemistry as of little use. It was studied by those who "wanted to know" and

laughed at or overlooked by those who wanted to "do things." Now, when we want to know what ails the feed water or whether the combustion is right or why the boiler plate isn't the right strength, we take those methods worked out by the men of pure science and make a chemical analysis. Then we compare the results with the facts that they discovered to see what's wrong.

Chanute made hundreds of experiments and computations to determine the laws of resistance of air and pressures on a bird's wing. Now flights to a mile and a half high are frequent.

Pasteur sought to explain why yeast fermented and his seeking developed the knowledge of germ action on which our whole modern system of prevention of contagious diseases rests.

Linnaeus studied the plants for the sake of knowing them. Modern medicine rests on the facts thus classified as to curative properties.

Michael Faraday was interested only in knowing the laws of magnets and in experiments which laid the foundation for the modern dynamo he sought only to know the relation of magnetism to electric current.

Why pile up examples? Back of every advance, except the occasional chance discovery lies the seeking of somebody to understand a law of Nature, and our knowledge of the laws of Nature is pure science. Applying them in doing things is engineering.

COMPARATIVE COST FOR THREE TYPES OF POWER PLANTS

IN the course of an investigation by F. W. Dean as to the cost of different types of power plants, indicated capacity 1000 hp., comparative figures were obtained as follows: For a reciprocating engine plant, Corliss engines run condensing, the following figures were given:

Estimate of Cost of 1000 I.hp. Steam Plant

	Per hp.	Total
Engine and condenser	$20.00	$20,000
Foundations	5.50	5,500
Electric generators	12.00	12,000
Boilers	7.50	7,500
Smoke flue	.75	750
Chimney	2.50	2,500
Heater	1.00	1,000
Pumps	.50	500
Buildings	20.00	20,000
	$69.75	$69,750

For operating this plant 13 per cent was allowed as fixed charges or $9.07 and attendance cost per horsepower per year was $3.21, the cost for oil, waste and supplies 20c., giving a total of $12.48 per horsepower per year for these 3 items. Fuel cost was estimated for 9 hr. a day, 310 days in the year and consumption of 1.75 lb. per hp. and 2000 lb. to the ton. This gives as the total coal used $9\times310\times1.75\div2000=2.441$ tons, and at $2.75 this gives a fuel cost of $6.71 per hp. per year or a total cost for charges, attendance, oil, etc., and fuel, of $19.19.

For a plant consisting of gas engines and producers, the costs were estimated as follows:

Two hor. doub. acting gas engines	$21,000
Two 300 kw. generators, 60 cyc., 220 v.	6,600
Two 38½ kw. exciter sets	3,000
Two producers	7,700
	$38,300
Add about 10 per cent for freight and erection.	3,800
Foundations	1,100
	$43,200
Add about 10 per cent for contingencies	4,300
Cost of buildings	20,000
	$67,500

giving a cost of $67.50 per horsepower. Figuring fixed charges at 14 per cent gives $9.45, attendance $3.21 and oil waste and supplies 50c., or a total of $13.16. To take care of standby and banking losses an allowance of 2 lb. of coal per kw.-hr. was made, which would be equivalent to 1.28 lb. per hp.-hr. On the same basis as before this gives 1.786 tons per hp. per year, which at $2.25 a ton gives $4.02 as fuel cost, or a total of $17.18 per horsepower per year.

For the third case, assuming the use of steam turbines, the aproximate costs for the plant are:

	Per kw.	Total
Two 300-kw. steam turbines with condensers	$47.00	$28,200
Boilers	12.00	7,200
Piping, flues, heaters, pumps, etc.	7.00	4,200
Foundations	1.00	600
Chimney	4.00	2,400
Buildings	20.00	12,000
Cost per kw.	$91.00	$54,600
Cost on i.hp. basis	57.00	

This will give a considerably lower operating cost than the others because of the lessened fixed charges, and the fuel cost may be considered the same as for the reciprocating engines. If 14 per cent be allowed for fixed charges, and the same attendance, oil and waste and fuel costs as for the reciprocating engines, the cost per horsepower per year will be $18.10.

WATER SOFTENING

By A. H. Allen

TIME alone suffices to precipitate the carbonates of lime and magnesia; the crystals of carbonate of magnesia formed are smaller than those of carbonate of lime, and when magnesia is present longer time must be allowed for the reaction to be completed before filtration, otherwise the magnesia crystals are formed between the lime crystals, blocking up the filters.

To obtain the best results, hard burned lime free from alumina or siliceous matter must be used, and the lime water must be completely saturated and clean. The lime water must be thoroughly mixed with the hard water, preferably by letting it fall in a thin sheet upon a similar sheet of hard water, in the correct proportions, and at least half an hour must be allowed after mixing (longer if magnesia is present) before clarification commences.

It is best to filter the water under a constant head through cotton cloths, which are cleaned when they become clogged by means of water jets, applied so as to pare off the film of precipitate rather than to drive the deposit into the cloth. To remove the permanent hardness more elaborate processes are necessary.

ROCHESTER DOIN'S

IT IS NOW on the map. Of course, it was in the Atlas before but it is now a definite, distinct place in the minds of some 2,000 or more visitors who spent a pleasant week enjoying its hospitality at the National Convention, Sept. 12-17. Every amateur photographic fiend knows where the cameras come from, but the visitors discovered a whole lot of other things that come from Rochester which are quite as good as the cameras.

Arrivals

BEGINNING on the 10th every one of the 117 steam trains which arrive each day unloaded delegates and their care-takers; not that the deelgates at the time of arrival needed supervision, but those whose wives had learned from past experience of the probable dangers of a convention, came along to see that their property was returned undamaged.

By Monday night most of the delegates had been unloaded and some of them partly loaded, and practically all exhibitors' representatives were on hand, which accounted for the condition of the aforesaid delegates. If the unwise exhibitors' representatives could be eliminated or induced to temper their generosity through the week it would be a good thing for the firms that they represent, as well as for the delegates in attendance who hesitate to refuse hospitality when offered.

As a whole the convention was notable for freedom from serious differences between either delegates or exhibitors. Usually some part of convention week has been enlivened with an interesting scrap due to honest difference of opinion, but at Rochester the spirit of co-operation seemed to be strongly in evidence at all times. The exhibit is described in detail in another part of the paper and it remains to give here briefly the business transacted at the convention sessions.

Monday was, of course, given up to registration and in the evening a reception with music was tendered to delegates in the ball room of the Seneca Hotel, also a meeting of the Exhibitors' Association was held in

DELEGATES AND VISITORS AT

the Armory at which a nominating committee was appointed and discussion was taken up in regard to the entertainment features for the convention, the decision being finally in favor of a concert by the "Bunch" on Wednesday evening.

Tuesday's Work

TUESDAY morning began the real work of the meetings, Wm. J. Ranton, chairman of the local committee, calling the convention to order. After prayer by Rev. E. P. Huddle, Mayor Edgerton was introduced, giving a cordial welcome to visitors and stating that after that morning better weather would be provided, a promise which was carefully kept.

National President William J. Reynolds, responding to the mayor, complimented the local committee on the program provided for the week and gave briefly the history of the work of the association in social and

THE ROCHESTER CONVENTION

educational lines. Geo. Dietrich, president of the Chamber of Commerce, spoke of the manufacturing interests of Rochester and gave the visitors an outline of what the city is and what it makes, to which Vice President Carl S. Pearse responded, speaking of the work that New York had done for the nation in an engineering way and in furnishing great statesmen and rulers, as well as leaders for the N. A. S. E.

Past President R. G. Ingleson, speaking of the problems of the day, mentioned the differences between capital and labor and ventured the hope that each would get to understand the viewpoint of the other so that responsible adjustment of these differences might be made.

Next on the program was Senator Geo. L. Mead, who spoke of the importance of the engineers' work and praised the habit of holding conventions and of attending them. He favored license laws for engineers because of the protection to the public, to the manufacturer and to the engineer, and stated that such laws were far better protection against boiler explosions than any system of inspection that could be devised. He urged the continued effort of engineers in New York to secure a state license law with the examiners appointed from a civil service list instead of by the governor.

Response to this was made by E. E. Pruyn, secretary of the New York State Association, who seconded the welcome of the other speakers and told stories to

illustrate the high standing of the association among engineers and the importance of their calling.

Chairman Ranton then turned the convention over to National President Reynolds, who appointed the necessary committees and mileage, then introduced President Wm. G. LeCompte, of the Exhibitors' Association, who told of the work of preparing the exhibit and invited all to the exhibit hall where a speech formally opening the exhibit was made by Vice President Pearse. Adjournment was taken until afternoon, at which time reports of officers were taken up.

President Reynold's Report

IN the report of President Reynolds statement was made that owing to lack of reports from practically 50 per cent of the states, no definite determination of membership could be made and he voiced a rather severe criticism of the laxness of state deputies and corresponding secretaries in attending to this part of their duties and furnishing the needed information.

Financial affairs of the association were reported in satisfactory shape, with no differences in subordinate associations which had been referred to the national officers. Moderate mileage expense for the Columbus and Rochester meetings would leave the treasury in good shape after the Rochester mileage was paid.

President Reynolds emphasized the value of the state associations and felt that the increase of membership and of subordinate associations must come largely from the work of state associations. He urged also that all subordinate associations should become members of the state associations and where there weren't sufficient subordinates to support a state that some district arrangement should be made with a near-by state having an association already formed.

He urged that more attention should be paid to the educational work so that criticism of neglect of that feature would not have ground, also that more liberal appropriations be made for that purpose. He mentioned the offer of a paper to be read at the convention by a representative of the National Electric Lamp Association, and while this offer was made after the program was completed, he urged that such papers should be made part of the work of national conventions as well as papers from members of the association. He urged also that representatives to the national convention should be apportioned on the basis of active members and that associate members should not count for this purpose.

He advocated the establishment of a pension fund but thought that participation in it should be entirely voluntary, also advocated that the fiscal year should end on the first of the month preceding the convention instead of on the 30th of June. President Reynolds also emphasized the fact that where social features are frequent the interest of members in the subordinate associations is kept active and the educational work is usually alive and healthful.

EXHIBITORS' REPRESENTATIVES IN FRONT OF THE EXHIBIT HALL

Report of National Vice President Pearse showed that as far as could be estimated the total membership was about 23,000. Comment was made on the work in each state and on the conditions of the association.

Secretary Raven's report showed 6 subordinate associations and one state association organized during the year, and 5 subordinate associations discontinued. Two subordinate associations have been consolidated with other associations. The reports showed 1,304 members initiated and 1,003 dropped, with the per capita tax paid by 307 associations on 17,825 members. Fifty-two associations showed 100 or more members, the largest being Illinois No. 1, of Chicago, with a membership of 529. National Treasurer Forse reported receipts of $24,929 and disbursements of $25,755 for the year ending June 30, 1910.

Committee Work

IN the report of the national educational committee particular attention was paid to the work on Gas Engines and Producers laid out by the Extension Division of the University of Wisconsin, Prof. E. B. Norris, who had the work in charge, writing a letter of high appreciation as to the quality of papers submitted by members of the association in answer to the questions. Ten associations secured a rating of 90 per cent or better on the answers to these questions, the highest being No. 2 of Ohio with 99.9 per cent. To the three highest associations a complete course in "Heat" prepared by the University of Wisconsin has been awarded and to the 7 following a course on "Fuels."

The License Committee reported effort to secure license laws in Kentucky, New York and West Virginia, which efforts will be renewed the coming winter in all cases. The city of Yonkers passed an ordinance providing for licensing of engineers and inspection of boilers.

Following this a paper was presented by Herbert E. Stone in behalf of the National Exhibitors' Association, advocating the control of state convention exhibits by a committee from the National Exhibitors' Association. A plan for such control was outlined which would bring the convention in sequence so that there would be no conflicting dates and that exhibitors could get full benefit from attendance at the state conventions. This involved an extra afternoon and evening of the exhibit prior to the session of the delegates, and the advertising of the exhibit by means of local papers and posters throughout the country surrounding the city of the convention meeting. This paper was referred to the committee on ways and means.

Wednesday morning the report of the credential committee showed 357 delegates entitled to vote. Proposed changes in the constitution were then taken up and as a number of them conflicted or overlapped, a committee was appointed to harmonize these and get them in shape where they could be understood and acted on without loss of time. Wednesday afternoon was taken up largely with the report of the board of trustees of the National Engineer and with consideration of the pension fund proposition. Changes made in the conduct of the paper were reported and the conditions were stated as being satisfactory with a promising future.

The committee on the pension fund reported $4,000 in the treasury of the Ladies' Auxiliary which they wished to turn over to the N. A. S. E. to establish a pension fund and the committee recommended that this be received and held in trust by the national officers until legislation could be enacted by the association providing for the conduct of the fund. The committee recommended also that until such legislation is enacted the fund be used for the relief of engineers in good standing who have become disabled, all orders for money drawn from the fund to be authorized by both the officers of the association and of the Ladies' Auxiliary, also that a committee be appointed by the president to draft suitable legislation for referendum. It was estimated that $750 a year would be required in addition to the income from the fund already in hand to take care of probable needs and that this might well be appropriated from the income from the National Engineer rather than raised by direct tax.

WM. J. REYNOLDS, PAST PRESIDENT

FRED W. RAVEN, SECRETARY

S. B. FORSE, TREASURER

This was put in the form of a resolution, the amount of pension in any case being limited to $120 a year, but at the meeting Thursday morning the president of the Ladies' Auxiliary, Mrs. Nella C. Moore, offered the objection that this would delay the work and asked that the association take some immediate action, which was done by appointing the president, secretary and treasurer of the N. A. S. E. as a board of trustees to arrange for organizing a pension department in conjunction with the officers of the Ladies' Auxiliary. A vote of thanks was also tendered to the ladies for their interest and for the fund which they had raised.

CARL S. PEARSE, PRESIDENT

At the morning session on Thursday President Reynolds read a statement showing the differences between himself and the board of trustees of the National Engineer, but these were considered in secret session.

1911 Convention City

ON taking up the place of meeting for the 1911 convention, Cincinnati, Mobile and Peoria were contestants for the honor, and Cincinnati won out by a considerable majority.

Proposed changes to the constitution which had been formulated by the proper committee, when taken up on Friday morning were laid on the table, so that the matter of biennial conventions, the national license committee for supervision of proposed laws and with power to act, limitation of the territory in which the national convention may be held, abolition of the referendum and change of the method of apportioning national delegates, were not acted on by the convention.

The other work of the Friday session was the election of national officers in accordance with the custom of Texas, and Trustee John A. Kerley, of Cincinnati, was re-elected.

Thus ended the business session of the convention, the social features being rounded out by the reception and dance in the convention hall on Friday evening, at which the new officers were installed and substantial evidence of the appreciation of his work presented to Past President W. J. Reynolds.

Exhibitors' Election

AT a meeting of the Exhibitors' Association held on Thursday evening the question of control of the exhibits at state associations was taken up and power was given to the president of the association at his discretion to appoint a committee of three to take up this matter with the officers of the state association. Election of

THE NEW OFFICERS OF THE EXHIBITORS' ASSOCIATION
TOP ROW, LEFT TO RIGHT: H. A. PASTRE, LANE THOMPSON, M. B. SKINNER, WM. G. LE COMPTE, H. D. RAYMOND, L. B. MANN; LOWER ROW: W. T. JOHNSON, H. H. ASHTON, W. D. PURELL, HOMER WHELPLEY

the association. Carl S. Pearse, of Denver, was elected as national president. The contest between Edward H. Kearney, of Boston, John F. McGrath, of Chicago, and Jas R. Coe, of New York City, resulted in victory for Kearney. Wm. J. Ranton, of Rochester, a candidate for the secretary's office, withdrew in favor of National Secretary Raven, who was re-elected by acclamation, as was also National Treasurer Samuel B. Forse, of Pittsburg. As conductor, G. J. Gibney, of Mobile, Ala., was chosen, and as doorkeeper, W. H. Lockett, of Dallas, officers by ballot on Thursday morning resulted in the choice of Wm. D. Purcell, of the Quaker City Rubber Co., Philadelphia, as president; Harry H. Ashton, Ashton Valve Co., Boston, vice president; Homer Whelpley, Strong, Carlisle & Hammond Co., Cleveland, secretary; W. T. Johnson, Underfeed Stoker Co. of America, Buffalo, treasurer. On the executive committee are: Lane Thompson, Lunkenheimer Co., Cincinnati; M. B. Skinner, James McCrea & Co., Chicago; L. B. Mann, of the Fairbanks Co., New York; H. D. Raymond, of A. W.

Chesterton & Co., Boston, and H. A. Pastre, Liberty Mfg. Co., Pittsburg.

At the meeting on Thursday evening Retiring President Wm. G. LeCompte, of Jenkins Bros., was presented with a handsome solid gold watch and a fob with charm emblematic of the Masonic orders up to the Mystic Shrine in token of the appreciation of the exhibitors for the work that he had done during the past year.

While Saturday was left over for visits to power plants and factories of Rochester, nearly all of the delegates left for their homes Friday evening and night, and by Saturday morning all that remained of the convention was the sound of crowbars and hammers as the exhibits were boxed for shipment.

Rash is the man who predicts what judgment the future will pass on current events, but the tendency to emphasize the importance of the social work of the association in the subordinate organizations and to give more attention to the educational features at the state and national conventions shows the growing appreciation of the two-fold objects of the order, and the establishment of a pension fund may probably prove to be the most important piece of legislation enacted at Rochester.

Entertainment

OF course, the entertainment in any convention is the chief reason for going to it. Business has to be done, but nobody ever would go to a convention just to do business and whenever there is an entertainment of any sort going on it is certain that the very few people who have neglected to attend it are kept away by necessity or else have lost the power of enjoyment. In this particular feature of the convention the ladies always get the "better half," which is quite proper, as they are it.

Poor man, as usual, has to do a day's work or at any rate make folks think he is doing one, while her ladyship is not obliged even to pretend to work when she is at a convention. Therefore, the ladies began Tuesday afternoon by touring the city and finished up the day at the theater party at the Lyceum Theater with their lords, who are not their masters.

Of course, every one was on hand for the big show Wednesday evening, which was given by the New York Bunch. The ladies, true to their mission, had spent the afternoon on an automobile and carriage ride and were in good spirits and quite as appreciative of the songs and monologues as the male portion of the gathering. Most of the numbers on the program were amusing and well rendered. Some of them might well have been eliminated.

Thursday was a day of relaxation for all. Special cars provided by the Exhibitors' Association took all hands to Manitou Beach where a baseball game (whoever held a convention without a baseball game?) was played between the engineers and the exhibitors. As the exhibitors were used to selling things to the engineers, they naturally sold the game, at any rate they said they did, and the final score was 13 to 4 in favor of the engineers. The only men who really played ball efficiently were the umpires, R. G. Ingleson and Jack Holman. They say that next time they are going to play with the teams and let somebody else umpire. Those who had an aversion to watching the baseball game or could not stand any more of that brand, had the opportunity to boat or dance until the dinner hour, which was made 4:30 to allow of early return to the city.

The unfortunate ones who had chosen to stay in the city during the afternoon gleefully welcomed back the unwise delegates who had traveled without wraps and returned much like a polar expedition, half frozen, entirely starved and full of glowing stories about the good time they had had, calculated to arouse the envy (?) of those who had missed it.

Somebody found the smoker which was planned for Thursday evening lying around loose and carried it off. There was smoke all right, but the vaudeville which had been scheduled evidently got moved across the street and was performing in the Temple Theater, at any rate no one saw it in the hotel. But the crowning feature, the reception and ball at the convention hall on Friday evening, was sufficient for all the evenings and no one missed the mislaid entertainment feature.

An interesting social feature of the week was the banquet of the Past National Presidents which took place at the Engineers' Club, Wednesday evening. This organization is especially interested in furthering the pension fund and other interests and 12 past presidents enjoyed an evening of joking and planning for future work. J. G. Beckerleg, of Chicago, was elected president.

MINNESOTA CAME INTO the list of state engineers' organizations with the first annual convention recently held at Minneapolis. In speaking before the convention, State Senator Fosseen recommended that the state should inspect all boilers instead of exempting those which are insured by some of the boiler insurance companies, and also favored the passage of an engineers' license law. While we can agree heartily with the latter statement, the former does not seem a necessary expense for the state to undertake, as all reliable boiler insurance companies for the sake of their own protection are careful in the inspection of the boilers which they handle.

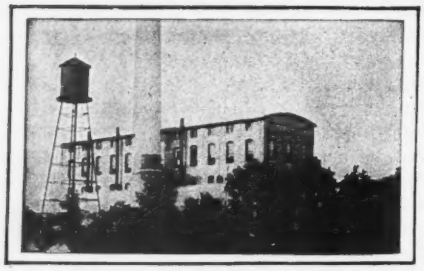
Chas. L. Pillsbury lectured on Local Power Plants, with lantern slide illustrations, and W. A. Converse, of the Dearborn Drug & Chemical Works, delivered a lecture on the Analysis of Water Pertaining to Steam, and showed by laboratory tests how such analysis was accomplished.

Officers elected were: President, H. M. Germain, St. Paul; vice president, Frank J. Striff, Winona; secretary, James McGeary, St. Paul; treasurer, J. A. Johnson, St. Paul; conductor, T. B. Wells, Minneapolis; doorkeeper, W. D. Strutt, Minneapolis. These officers were installed by National Secretary F. W. Raven, who also presented a past president's jewel to J. A. Williams, retiring president.

In connection with the convention the first exhibit of the Central States Exhibitors' Association was held and a permanent organization effected. The officers chosen for the ensuing year are: President, W. P. Lyons, of the Lyons Boiler Works, Chicago, Ill.; secretary, E. P. Gould, Chicago; treasurer, John B. Freye, Chicago; vice presidents were elected in each state as follows: Minnesota, S. Rollins, Minneapolis; Illinois, W. A. Converse, Chicago; Iowa, Joseph Williams, Des Moines; Indiana, M. Gurney, Indianapolis; Michigan, Joseph Myers, Detroit; Wisconsin, Fred Brunner, Milwaukee; Missouri, H. Stewart, St. Louis. The executive committee consists of F. E. Ransley, Milwaukee, chairman, Robt. E. Hills, Mortimer Neeley, O. Monnett and J. Tibbles, of Chicago.

WITHDRAWAL OF PREMIUMS

BEGINNING with Nov. 1, 1910, all offers of premiums with a 2-yr. subscription to Practical Engineer, at $1.50 will be discontinued. The subscription price will be as heretofore $1 for one year or $1.50 for 2 years, but no premium will be given with a subscription at these prices.



Power Apparatus

In Shop and Market

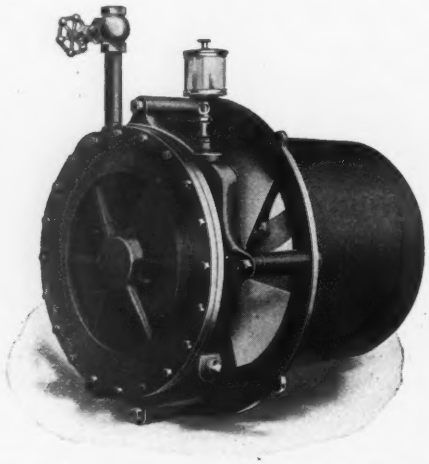
New Ideas in Making, Buying and Selling

TURBO UNDERGRATE BLOWER

THE B. F. Sturtevant Co., Hyde Park, Mass., has recently placed upon the market a Turbo Undergrate Blower that deserves careful consideration by all engineers who have supervision of steam generating plants.

Construction of these blower sets is simple, durable and strong, and consists of a single-stage impulse steam turbine direct connected to a propeller type fan. The bucket wheel of the turbine is a solid steel forging carefully machined, the steam buckets being milled on the periphery of the bucket wheel.

Steam nozzles are made of Tobin bronze and are held in place by composition draw-up nuts. The construction of the steam case gives great accessibility for inserting, removing or cleaning the steam nozzles.



THE STURTEVANT TURBO UNDERGRATE BLOWER

Ample dust proof phosphor bronze bearings and thrust washers are provided with oil cup lubrication, the construction of the bearing making it possible to renew the bearing at a small cost.

In the built-up fan 6 polished sheet aluminum blades are rigidly fastened with hard drawn copper rivets into a bronze hub, which is finished all over to secure the proper balance necessary for the high rotative speed of these sets. The materials used in the construction of the fan insure great mechanical strength and also great corrosive resisting power.

Stationary members of the blower set are constructed of cast-iron parts of ample strength and rigidity.

Practically silent in operation, the Sturtevant Turbo Undergrate Blower requires a minimum amount of care and attention as it can be controlled by a hand damper regulation or by regulating valves operated by the boiler steam pressure.

As the exhaust steam from the turbine contains no oil it may be used to best advantage for any work to which exhaust steam may be put, such as feed-water heaters, heating, etc. When discharging into the ash pit it produces excellent results with coals that ordinarily would cause serious trouble by clinkering.

Cost of installation of this blower is exceedingly small. The wall thimble which forms anchorage for the set can be placed with equal ease in the front, side or back wall of the brickwork of the boiler setting. The ease of installation combined with the small cost should make these turbo blowers of special interest to all plants where it is desired to increase boiler capacity, or in cases where the maximum efficiency is not being secured from the fuel.

These blower sets can be applied with excellent results to power plants that fall under the following classification:

1. Electric light and railroad power plants that need increased draft during the peak of the load.
2. Power plants that have outgrown their stack capacity and need 25 to 50 per cent increase in boiler horsepower.
3. In heating systems for hotels, department stores, flats, schoolhouses, etc.
4. In small plants that need an increase in boiler horsepower.

DIAMOND DAMPER REGULATOR

HEREWITH is illustrated the Diamond Damper Regulator, which has the novel feature in construction that it uses mercury as a balancing power to control the inlet and outlet water valves.

This mercury is used in connection with 2 hollow globes, which are supported by a connecting arm, resting on a knife edge in the center. These globes are also joined by a bypass, through which the mercury moves back and forth as the steam pressure increases or decreases. Movement of the mercury from one globe to the other brings an increase in weight on one side or the other of the knife edge, as the case may be, which causes the connecting arm to tip; the tipping of this arm opens or closes the water valves which control the damper.

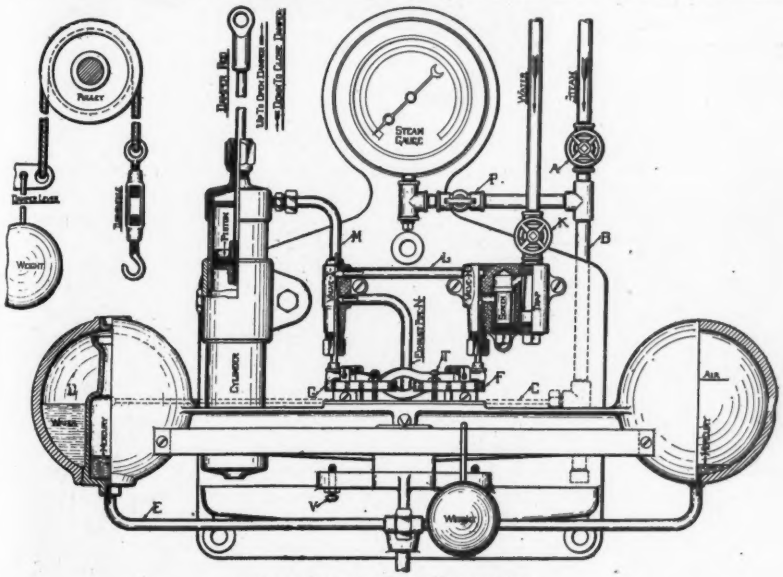
Another distinctive feature is the simple method of regulating the steam pressure point at which the damper will be closed, which provides for changes between day and night pressure of steam or for a change at any time desired. This is accomplished by simply sliding the weight to the right or left on the bar.

An important point in construction is the ease of access to the water valves, which in the Diamond Regulator are so constructed that the stems may be reground into the valve seats without the removal of the stem from the valve body, or the removal of any other parts of the regulator.

As the cut will indicate, the regulator is connected to a water or air supply, which should have a pressure of at least 20 lb. It is also connected with a steam line carrying boiler pressure, see A B P. A being the controlling valve of the regulator and P showing the connection with the steam gage.

B carries the steam to a flexible drawn copper tube C, which connects with globe D on the left. Globe D is filled with water caused by condensed steam. As this globe fills, it drives the air through the inner chamber, as shown in the cut, and through the bypass E, driving the mercury before it into the hollow globe on the right. As the pressure in both globes becomes equalized, the mercury naturally drops back into the bypass, where it remains to be shifted from one side to the other, according to the increase or decrease of the steam pressure. When the steam reaches the required pressure, the counterweight as shown in cut is placed on the scale in such position as exactly to balance the 2 hollow globes.

As the steam pressure rises above that desired, the mercury is driven towards the hollow globe on the



DIAMOND DAMPER REGULATOR

right, which increases the weight on this side and tips the arm. Tipping the arm opens the inlet water valve H by means of a lever connected at F with the valve stem and extending across the knife edge rest and touching the balance arm by the use of an adjustable set screw T. The water before reaching valve H passes through a trap or settling chamber and a screen. After passing valve H, the water flows through L and M to the cylinder, driving the piston down, which closes the dampers.

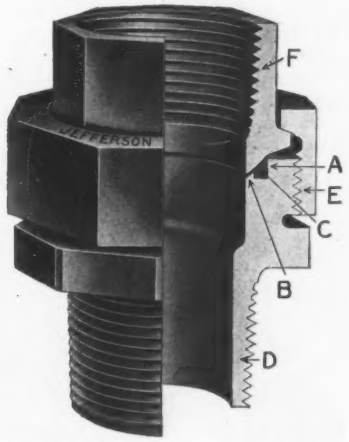
As the steam pressure decreases, naturally the pressure in the globe D on the left also decreases and the compressed air in the hollow globe on the right assists in driving the mercury back to the left, causing the left end to become heavier. This movement of the mercury, of course, tips the arm down to the left side and closes the inlet valve H, which shuts off the water supply. At the same time it opens the outlet I, which allows the water to flow from the cylinder back through M into waste pipe N, and the piston is drawn up by the weight of the damper as it opens.

Great sensitiveness is the result of the method of control and wear is found only on the plunger leather, which is a 2-in. standard cup easily replaced. As it is capable of any power it may regulate from one to a dozen dampers and holds the pressure variation within 2 lb. For stoker fed boilers, or those burning oil or gas, the regulator may be arranged to control the stoker drive or the oil or gas feed and will hold at any steam pressure from 3 to 500 lb.

This regulator is the product of the Diamond Power Specialty Co., Detroit, Mich.

JEFFERSON MALE AND FEMALE UNION

EVERY practical steam fitter knows well enough that with a male and female union he can save a nipple, avoid an extra joint, and do the job in 2-3 the time with more than double the assurance that it will stay tight. What is more he can make a good deal shorter connection; this counts for much where there isn't an inch to spare. But the better the union, the better the job. This new style



JEFFERSON TYPE F UNION

Jefferson Type F male and female union, made by the Jefferson Union Co., Lexington, Mass., is built on the principle of a spherical, ground, brass-to-iron joint.

A brass ring A forms the seat or contact, and is firmly embedded in a channel in the part having an external thread. All the rest of the fitting is of malleable iron. This ring is of wrought metal, cut from seamless brass tubing, so that there is no chance for blow holes. The brass-to-iron joint is used because it is noncorrosive.

It is a matter of common knowledge that with temperature changes, brass expands or contracts more than iron, and that this difference tends to leave an opening between the 2 metals, hence a small amount of brass is used as it expands and contracts less, but enough is used to do the work.

The iron wall B absorbs the heat and distributes it through the iron, so that much less reaches the brass than other construction. The wall also protects the brass from injury, no matter how far the pipe is screwed in, and makes the ring practically one piece with the iron, so that it cannot become dislodged.

No gasket is used, which means a saving in time and expense. There's plenty of play for the part F

which swivels in the nut, so that it's easy to make a tight connection even though the pipes are not in perfect alignment.

The brass ring is cut at C to fit the spherical end of the opposing member, and 2 parts then ground together.

Without sacrificing a single desirable feature, the Jefferson style F is as short as any male and female union on the market; consequently it can be used for short connections. But short as it is, any style wrench with any width face may be used on any of the 3 parts. The octagon flats of all 3 parts are so arranged that there's no interference. On the clamping nut the flats are outside, clear of the corners of the part D having the external thread. On the part D, the flats are outside and clear of the nut threads.

THE KOMO STEAM TRAP

THIS operates by the expansion of the side rods which are shown in Fig. 1. The rods are somewhat longer than the section of pipe which constitutes the body of the trap. As the water enters this tubular body and cools it, the tube will shorten and thus tend to buckle the rods or bend them upward in the middle. This will force the standards at the side upward and will lift the valve, as will be evident by examining the cross section view in Fig. 2.

Steam pressure driving behind the water will then force it out of the receiving pipe through the inner tube and out of the valve and outlet, the outlet being from the side of the valve above the trap, as seen in Fig. 1.

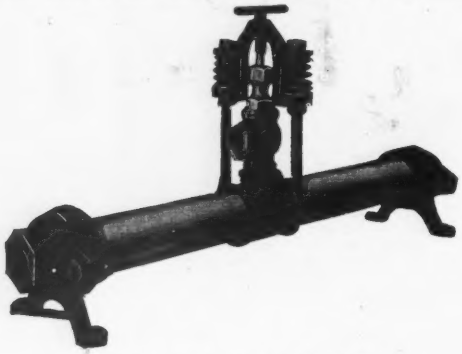


FIG. 1. THE KOMO STEAM TRAP

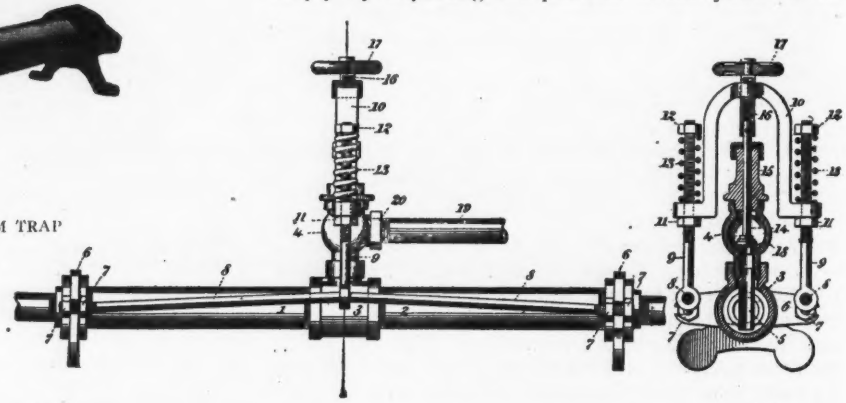


FIG. 2. CROSS-SECTION OF KOMO TRAP

As the water leaves the receiving tube, steam enters, expanding the pipe and lengthening it so that the side rods are pulled downward, drawing the vertical rods down with them until the valve is pulled to its seat by the action of the springs on the side rods. If the trap gets over hot, thus pulling down on the side rods more than is necessary to close the valve, the extra motion is simply used up in compressing the springs and does no harm to the valve or trap.

The tube below the valve forms a water seal with the inner tube so that the steam strikes the surface of the receiving tube and expands it sufficiently to close the valve before the water is entirely forced out, thus forming a seal to prevent the escape of steam.

It will be seen that the trap is simple in construction, with few moving parts, and these of the simplest form. The valve opening is large, giving it great capacity, and as much water can be forced out through the outlet as can enter through the inlet connection. This large valve opening also insures free flow and practically instantaneous discharge of condensation, so that floods or sudden rushes of water are taken care of without difficulty. No by-pass is required on the valve and when it is desired to clean it of scale or dirt the valve can be opened by screwing up the hand wheel and letting the steam and water blow through. If it

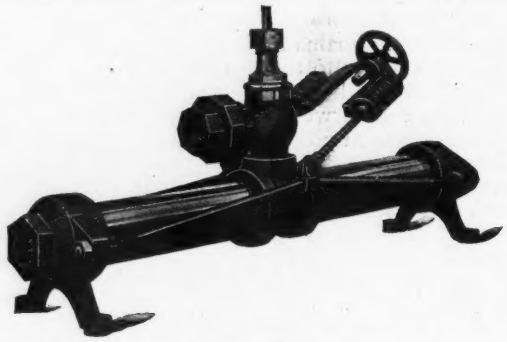


FIG. 3. METHOD OF REMOVING VALVE AND BONNET

be desired to remove the valve for inspection, the side rods and yoke may be thrown to one side, as shown in Fig. 3, and the valve and valve bonnet can be removed, the same as for any other steam valve.

A distinct advantage of the Komo trap, because of its method of operation, is that it may be used as a thermostat for keeping the water at any degree of temperature in hot water heating or plumbers' tanks, simply by adjusting the position of the yoke on the side rods so that the valve will open at any desired temperature. This trap is the product of The Linton Machine Co., of New York City.

GOING SOME

THREE hundred miles in 9 hr. by airship with a load of 20 people sounds like a Jules Verne story, but in this age of wonders it's only a 3-in. news item about Count Zeppelin's airship line. The Deutschland making 50 per cent faster time than the express trains with ability to carry 22 tons, of which only 5½ tons is live cargo, requires 300 hp. to drive it. And it is booked for a rush business. The fare is, however, $50, so we shall take the train until excursion rates come in.

PLASTIC FIRE BRICK

WHEN installing a furnace the problem always comes, What material can be used which will give the best service at the least cost? A fire brick which can be molded to any shape desired is, of course, an advantage and the Betson Plastic Fire Brick, made by the Betson Plastic Fire Brick Co., of Rome, N. Y., has this advantage. It does not come in molded form but is moist and may be shaped to any form in the place where the setting is erected. It is shipped in barrels ready for use and does not require fire clay or other material in putting up the setting.

The manufacturers guarantee that it will not contract or expand, therefore will not work loose nor fall down, and can be built into a solid arch above fire doors. When repairs are necessary the surface may quickly be faced up by the addition of more of the plastic material and cracks between sections may readily be filled. A one-piece arch and lining is manufactured from it by the makers, who have put it to the test for 15 yr. The product does not glaze over but forms a gas and air-tight lining and has a surface to which clinker does not readily adhere. Those who have used it are enthusiastic in speaking of it.

INDUCTION TYPE POTENTIAL REGULATORS

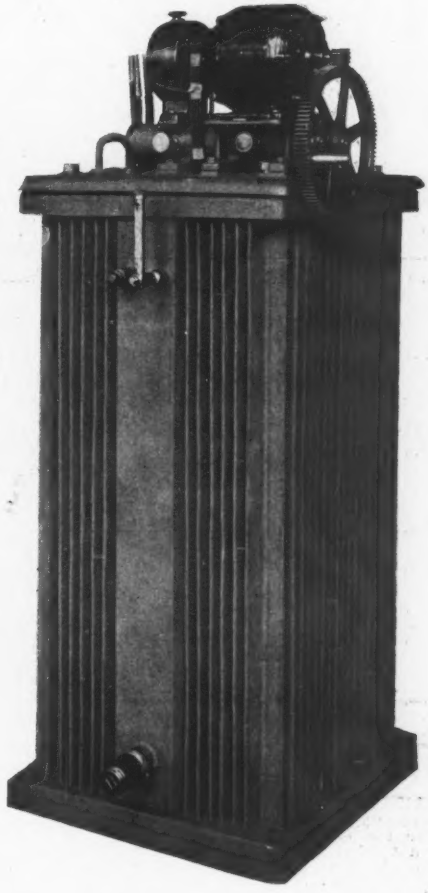
SEVERAL recent improvements are embodied in the motor-operated single-phase induction regulator shown in the accompanying illustration, which is made by the Westinghouse Electric & Mfg. Co. Although the general design of these regulators remains unchanged, modifications have been made that insure not only a higher degree of satisfactory operation, but longer life.

The skeleton frame construction of the new type single-phase potential regulator permits the use of a cast-in corrugated sheet-metal tank which affords a larger and more efficient radiating surface than the cast-iron tanks used with the earlier regulators, thereby insuring a low operating temperature. This type of tank is also less liable to give trouble from oil leakage, which sometimes occurs with the cast-iron tanks on account of unavoidable defects in the castings.

In the latter, the leaks usually developed after the punchings and windings had been placed in position, thus causing considerable loss of labor in the work of rectification, while it is noteworthy that in the case of the cast-in tank a defective tank entails no other loss than the tank itself. In the earlier designs, the cast-iron tank was bored out to receive the stator punchings. As this tank was open only at the top, difficulty was sometimes experienced in obtaining inner cylindrical surface which would be in perfect alignment with the rotor bearings located in the cover and bottom of the tank.

Up to and including the 95-kw. size, the polyphase regulators have cast-in corrugated sheet-metal tanks. They are similar to and possess all the advantages of the cast-in type of tank. They possess great strength mechanically, have large radiating surfaces and dirt and dust-proof qualities. An oil gage at the top and a valve as oil drain at the bottom are provided. Above 95 kw. the regulators are usually oil insulated and water cooled. Boiler iron cases with cast-iron bases and covers are usually used.

The single-phase regulator has an inherent tendency to vibrate, but this has been overcome in the Westinghouse regulator by a careful design of the bearings and shaft. The moving element is carefully centered so that a uniform air gap is secured. Furthermore, the tendency to vibrate is reduced due to the low point on the saturation curve at which the magnetic circuit of the regulator is worked.



WESTINGHOUSE INDUCTION TYPE POTENTIAL REGULATOR

POWER COSTS

SOME light on the subject of power cost for mills is furnished by recent tests conducted by D. C. and W. B. Jackson. The plant tested was 1500 hp. running 6 days a week, 24 hr. a day, and the test showed that the cost per horsepower per year was $32.60. In a paper before the Boston Society of Civil Engineers, Messrs. Main and Gunby gave for similar installations $37 per indicated horsepower per year for a plant of 250 hp. with a 24-hr. load.

There was a difference in price of coal in the 2 cases which accounts for the difference in figures for the 2 plants, the latter plant using coal which costs $4.75 a ton, nearly twice the cost at the former plant. Also the 24-hr. load gave somewhat better economy. A generally accepted figure for a 10-hr. a day load is $20 per horsepower per year, amounting to 1.065c. per kilowatt-hour, while the cost shown by Messrs. Jackson corresponds to 0.6c per kilowatt-hour.

IN THE ARMORY AT ROCHESTER

HIGH water mark for the number of exhibitors and number of spaces was established by the dandy exhibit on the two floors of the Old Armory building. Some of the exhibitors were inclined to think that the upper floor was not as desirable as the lower, but after the band got going it was noticeable that exhibits on the upper floor were fully as well patronized as those below stairs. Every convenience was provided for the installation of exhibits and the arrangement which made the entrance to the convention hall through the exhibit hall gave all delegates convenient chance to investigate without going out of their way. Of course, no man in the leisure hours of a convention can do entire justice to 200 exhibits in 4 days, but each man had a chance to investigate those things of the most immediate interest and exhibitors expressed themselves as well satisfied with the attendance and the results.

Following the alphabetical arrangement of exhibits as given in the memorandum and directory prepared by Practical Engineer and distributed to all in attendance at the convention, the most prominent features at each booth were as follows:

In the Exhibit Booths

Acheson Oildag Co., of Niagara Falls, showed its compounds of deflocculated Acheson Graphite with water and with oils and with greases for lubrication of different classes of machinery. Curves were presented showing the reduction of friction with Gredag and length of run after the lubricant is shut off, using oil alone and oil mixed with graphite. In attendance at the booth were Orrin E. Dunlap, R. B. Clark and E. G. Acheson, Jr., presenting visitors with fobs showing the Acheson trade mark, folding rules and letter openers.

Alberger Condenser Co., of New York, illustrated the method of controlling the temperature in hot water heaters by means of a brass pipe for the outlet which expanded and contracted, thus opening or closing the inlet valve from the steam pipe. An exhaust line expansion joint of corrugated copper was shown for 14-in. pipe, capable of taking up ½-in. expansion and also a joint for 4-in. pipe suitable for 200 lb. pressure. These joints have flanged ends for taking gaskets at the joints, and reinforcing rings for high pressures. The heater shown had cast-iron shell and copper tubes and would heat 500 gal. of water per hour from 50 to 180 deg. with steam at 212 deg. S. C. Ross was in charge of the exhibit.

The Allis-Chalmers Co., of Milwaukee, arranged a palm garden for the convenience of visitors and in it showed a model of a 450-hp. turbine sectioned so that all details of the machine could be examined and their action in operation studied. Solid silver souvenirs were presented to those guessing the nearest to the number of turbine blades enclosed in a glass case in the exhibit. The winners and their guesses being as follows:

Total number of blades, 18,638. The nearest guess, Miss Lillian Leopard, Jamestown, N. Y., 18,640, winning a sterling silver purse. Second nearest, F. J. Leopard, Miss Leopard's father, guess 18,642, winning glass and filigree silver decanter. Other ladies winning guesses were as follows: Second, Miss Irene Mull, Mansfield, Ohio, silver chain purse; third, Mrs. F. E. Ratheiser, Dayton, O., and Mrs. M. T. Rouse, Covington, Ky., filigree silver cologne bottle and sterling silver picture frame; third, Mrs. A. J. Malin, Phoenixville, Pa., and Mrs. G. Wilborn, of Rochester, N. Y., sterling silver picture frames.

Sterling silver souvenir spoons were won by: Mrs. Dudley Thurston, Jersey City, N. J.; Miss Lydia Doyle, Pittsburg; Mrs. S. F. Babbitt, Providence, R. I.; Mrs. Olan Kile, Decatur, Ill.; Mrs. A. P. Stevens, Everett, Mass.; Mrs. J. A. Carson, New York City; Miss Lottie Gerske, Detroit, Mich.; Mrs. R. J. Brooks, North Bridge, Mass.; Miss M. A. Hobson, Geneva, N. Y.; Mrs. Lane Thompson, Cincinnati, Ohio; Mrs. E. Stakes, Cleveland; Mrs. C. H. Utter, Newark, N. J.; Mrs. Wm. Hocking, Chester, W. Va.; Mrs. Fred Silver, Cincinnati; Miss Marion Amersdorfer, Detroit; Mrs. R. W. Smith, St. Louis; Mrs. J. B. Burkhart, Rochester, N. Y.; Mrs. Riley Daniels, Central Falls, R. I.; Mrs. F. H. Reed, Cleveland; Mrs. A. S. Grokert, Dayton, Ohio; Mrs. J. B. Youngblood, Cleveland; Mrs. Geo. A. Mull, Mansfield, Ohio; Miss Mabel Brienley, New York City; Miss Margaret Holland, Pittsburg; Mrs. F. A. Yaeger, Cincinnati.

Delegates coming near to the number were: Second, L. G. Kelso, Moline, Ill., silver mounted buckhorn handle cork screw; third, J. R. Moore, Chicago, selver mounted cork screw.

Delegates receiving souvenir spoons were: F. Pankerton, Chicago; H. J. Thompson, Los Angeles, Cal.; Riley Daniels, Central Falls, R. I.; J. Battle, New York City; Jos. N. Gregory, Buffalo; Edward J. Burke, Philadelphia; S. K. Page, Boston; E. R. Dobbin, Geneva, N. Y.; J. A. McMahon, Zanesville, Ohio, and O. J. Bennett, Portland, Oregon.

For exhibitors the first prize went to J. M. Voltz, of the Peerless Rubber Co., sterling silver flask; P. J. Rimmer, of the Ridgeway Dynamo & Electric Co., safety razor; H. L. Browne, Jr., Peerless Rubber Co., silver mounted cork screw; and souvenir spoons went to the following: Frank Martin, Jenkins Bros.; H. C. McLaughlin, Jenkins Bros.; L. B. Mann, The Fairbanks Co.; Dan Delaney, Dearborn Drug & Chemical Works; E. S. Storm, American Radiator Co.; A. W. France, France Packing Co.; C. F. Heitzman, Peerless Rubber Mfg. Co.; E. R. Shaw, Technical Publishing Co.; Wm. MacDonald, Hartford Boiler Insp. & Ins. Co., and Harry B. Aller, Manning, Maxwell & Moore.

The company was represented at the convention by F. S. Sly, R D. Tomlinson, C. R. Tatem, Rex T. Stafford, F. C. Randall, L. L. Willard, C. A. Burns, A. P. Peck, E. T. Pardee, H. L. Watson, M. H. Merrill and F. G. Bolles.

American Radiator Co., Bundy Dept., New York, N. Y., was represented by W. E. Van Kueren, E. M. Stevens, A. L. Lissen, and A. E. Jones, and showed Bundy traps with tilting bucket for both tank service and return service, and as a special feature a tank trap ordered by mistake which was ingeniously converted by the engineer in charge of the plant into a return trap, using such valves and connections as he could find about the plant. The operation of traps was shown by sectioned models in which all details of the bowl connections and valves were made clear.

In its Specialty Department the American Radiator Co. of Chicago showed the Sylphon specialties, having a copper bellows as the controlling feature. This bellows expands under pressure and contracts when the pressure is released and is applied to tank regulators, pressure reducing valves, damper regulators and temperature control systems. The bellows is made of a single piece of copper without a circular seam and is extremely sensitive in its action. The company was represented by E. S. Storm and F. C. Reeder.

American Ship Windlass Co., of Providence, R. I., presented to visitors at its booth a convenient automatic steam table which shows for any pressure by means of a movable slide the temperature, total heat, heat in the water, and the weight per cubic foot of the steam. A blue print in the exhibit showed the application of a double Taylor Gravity Underfeed stoker to a new design of water-tube boiler for the Detroit Edison Co., and photographs of the Taylor stoker were shown on vertical and horizontal boilers. The special claims of the Taylor stoker are 100 per cent overload capacity, 50 per cent decrease in labor, 25 per cent less fuel, and 100 per cent less smoke than the hand firing. Representatives were J. F. Mallory and Mr. Alpern.

American Steam Gauge & Valve Mfg. Co., of Boston, represented py U. H. Nickerson, showed the American dead weight gage tester with screw pump, the American special pop safety valve with adjustable blow-down ring, brass specialties of various kinds, American Thompson Improved indicator with outside spring and Ideal Reducing Wheel, and an indicator equipped with electric pencil action for taking simultaneous cards from 2 or more indicators.

The V. D. Anderson Co., of Cleveland, Ohio, illustrated its new Model D trap in section. This has a strainer for preventing the inlet of foreign matter, a bypass valve operated by an eccentric showing by the position of the handle whether the valve is opened or closed, an interchangeable valve and valve seat with screw follower by means of which the trap can be changed from high to low-pressure service without removing the cover of the trap or breaking the pipe connections. Another feature of the exhibit was the engine room oil filter in which the oil passes through filter paper, this paper being renewed whenever necessary. Jos. H. Meyer and R. E. Bronson were the representatives.

Arrow Boiler Compound Co., of St. Louis, was represented by Frank A. Foster and E. M. Swindler, who explained the merits of Arrow brand boiler compound for removing and preventing scale. A souvenir watch fob was presented to delegates.

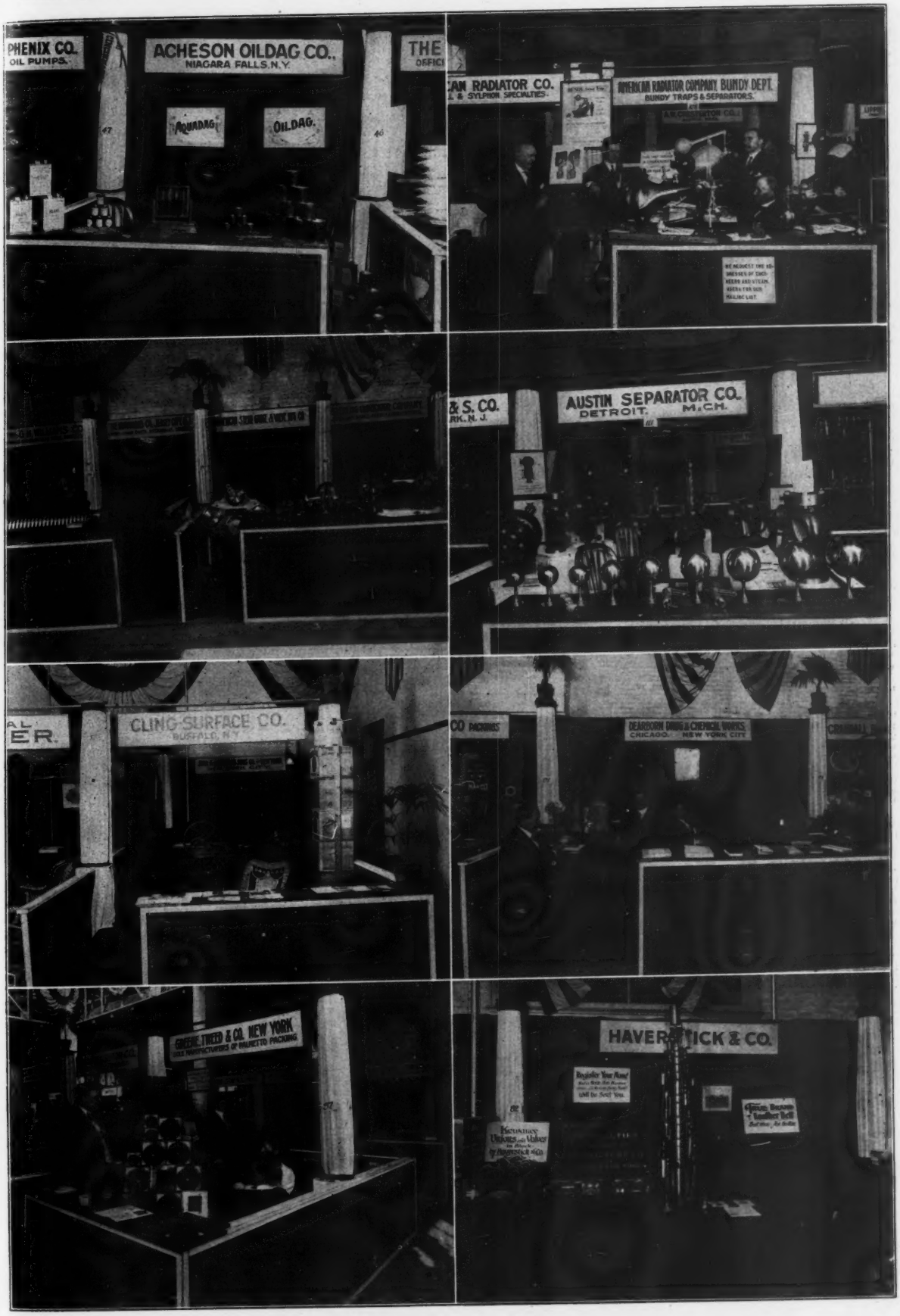
Ashton Valve Co., of Boston, made a special exhibit of the Ideal Alarm Gage and of the Ashton Visible Action Indicating Gages in which the mechanism of the gage is open at all times for inspection. Also in the exhibit were Ashton special valves, including the pop safety with locked adjustment, relief and blowoff valves, inspectors' testing outfit and the Ashton Dead Weight Gage Tester. Representing the company were Harry H. Ashton, Columbus Dill and C. W. Houghton.

Austin Separator Co., of Detroit, was represented by H. J. McGregor and illustrated its product by means of full sized sectioned separators showing the internal construction and details of the special oil separator, vertical and horizontal steam separators, and the Elbow Angle separator with and without receivers.

The Best Mfg. Co., of Pittsburg, represented by Chas. K. Thomas, John D. Hiles, and C. W. Bergen, prepared a display of valves, fittings, cocks and unions, arranged in a special design, features of which were the extra heavy pipe bends which are bent by a new process, using spools for rolling, and heating the pipe in strips. An indicator shows at all times just the radius to which the pipe is being bent. Also welded headers were shown in which the metal is reinforced at the corner, making specially strong construction. Best gate valves with adjustable wedge disk, Van Stone flanges and rolled steel flanges were included in the arrangement. A special union had the property of being flexible in one position and rigid with another arrangement of ring and socket. In the large iron body gate valves the bypass is arranged with bent pipe, thus permitting of expansion of the bypass connection when the steam is turned on.

Bird-Archer Co., of New York, was represented by Wm. J. Schatz, "assisted by the entire delegation of representatives from New York." He explained to friends the merits of Bird-Archer Boiler Compound for removing boiler scale, the action of Bird-Archer Elevator Emulsions, and as a souvenir presented cuff buttons made from the N. A. S. E. badges.

Builders' Iron Foundry, of Providence, R. I., showed a 4-in. Venturi Meter for measuring hot boiler feed water and also the Indicating Dial Register and Recording Chart.


PHENIX CO.
OIL PUMPS.
ACHESON OILDAG CO.
NIAGARA FALLS, N.Y.
AQUADAG
OILDAG.
AMERICAN RADIATOR COMPANY. BUNDY DEPT.
BUNDY TRAPS & SEPARATORS.
AUSTIN SEPARATOR CO.
DETROIT, MICH.
CLING-SURFACE CO.
BUFFALO, N.Y.
DEARBORN DRUG & CHEMICAL WORKS
CHICAGO NEW YORK CITY
GREENE, TWEED & CO. NEW YORK
HAVERSTICK & CO.

This apparatus measures the flow of the water, shows how much is flowing at any time, takes a meter register of the total flow and on a chart records the flow at each instant, thus giving a complete record of the water passing through the meter. A planimeter was also shown for totalizing records where no register dial is provided. N. L. Sammis represented the company.

Cancos Mfg Co., displaying in its exhibit Black Squadron Packings for all kinds of uses, including sheet, square, round and ring, also stranded valve spool packings and Cancos Metal Polish, conducted a prize drawing for a gold watch in charge of Harry Harmstadt. The watch was won by J. Wright, of Rochester, N. Y.

For A. W. Chesterton Co., of Boston, H. D. Raymond was in charge of the exhibit in which was included Combination scraper and flue brush, Chesterton Flax Packing, Rubberbestos and Metalbestos, Warrior and Metallo Packings, the latter being a metal-covered combination steam and hydraulic, and the Mound scrapers and packing tools.

Claflin Patent Steam Tube Cleaners with skeleton head were shown by Chas. A. Claflin & Co., of Boston, represented by Mr. Claflin and Merrill M. Davis. In connection with the tube cleaner, which has a skeleton head and is made for tubes from 2 to 6 in. in diameter, the telescope balanced steam valve was shown as used on the cleaners for tubes from 3 to 4¾ in. in diameter. This valve and cleaner are arranged as described in the issue for September. A special steam hose was also shown in the exhibit.

For the Cling-Surface Co., of Buffalo, Dr. Wm. D. Young and T. H. Clark had arranged an interesting test showing by means of spring dynamometers and 2 sets of belts and pulleys the difference in power transmitted by belts with and without Cling-Surface treatment. They showed also belts after 10 years' service, those being without treatment having become stiff and hard, and the treated belts being in as good condition as when first put on.

Albany Grease, manufactured to the same standards for 42 years, was displayed in the exhibit of Adam Cook's Sons by the representatives, M. D. Peavy, Geo. E. Tanberg, and W. B. Naughton. This was shown in all grades for different lubricating purposes, the display consisting of pyramids of cans and boxes. The company offers $1 an ounce for all grease that gets rancid while waiting to be used. Celluloid novelties and gas balloons were the souvenirs distributed.

The Chicago Die & Stamping Co. provided a stenographer at its booth for the convenience of visiting delegates and displayed a large line of Fleisch Combination Metal and Packing Gaskets for all conditions. These gaskets are made in both round and flat cross section and in round and elliptical form, the filling being made of rubber, lead or asbestos, as most desirable for the service required. R. Edwards was in charge of the exhibit.

For the Crandall Packing Co. John M. Chapman was, as usual, on hand, and with John Kaymel and Stephan Nauerth presented visitors with pencils and explained the merits of the Crandall packings, particularly the new style "llp" hydraulic, the Helios fiber sheet for superheated steam and the Regina sheet and Helios Stine braided and twist. Delegates were presented with a thermometer mounted on a piece of Helios sheet with the statement that the glass could be melted before the sheet would be destroyed.

Crane Co. in an interesting exhibit, which was in continuous operation, showed the method of feeding boilers under pressure by the use of steam traps. Three traps were used, one of them a tank trap for draining liquid from any system, the second a return trap for lifting water above the boiler, and the third a gravity trap for letting the water into the boiler. Models were shown of trap valves, the Crane pop safety valves, motor-operated valves for remote control, and globe and gate valves. J. L. Forsythe and N. S. Oswald were the representatives.

Paul L. Crowe presided at the booth of the Crowe Iron Works Co., of Jersey City, explaining the construction of the Crowe chain mechanical stoker by means of drawings, full sized samples of the grate bars, and sections of the grate. He also showed the Crowe practical oscillating engine which is used for producing power from a blacksmith forge. This engine attached to a forge will furnish power to drive a 10-in. lathe, drill press, grindstone, emery wheel, blower for the forge and dynamo to light 6 16-c.p. lamps, all from the steam formed by the forge fire. Blotters and erasing shields were presented to visitors at the booth.

Davidson Simplex Pumps shown at the booth of the M. T. Davidson Co., of New York, represented by John Lowe, Thomas Ellerby, and Alden L. Covill, are provided with positive steam valve and are designed with small clearance. They have double steam and water valves and on test have shown with 90 lb. steam pressure as low as 46 lb. of steam used per water horsepower per hour. The full sized pump shown was 5½ by 3¼ by 8 in., with nickel-plated steam cylinder. A letter opener was presented as souvenir.

Representatives at the convention who did not have exhibits in the hall were H. A. Freeman, for the G. M. Davis Regulator Co., Chicago; M. E. Briggs for the Pilley Packing & Flue Brush Mfg. Co., of St. Louis; G. H. Beebe for the Fisher Governor Co., of Marshalltown, Iowa; Edwin P. Moritz for the Edge Moor Iron Co., of Edge Moor, Del.; Sam Rosenthal for The City Fuel Co., Chicago; H. J. Manzel for Manzel Bros., of Buffalo.

W. E. Sanders, of Cleveland, the father of old Bill, was present, much to the pleasure of his large number of friends.

As usual at the headquarters of the Dearborn Drug & Chemical Works jokes were the order of the day. Herbert E. Stone, P. H. Hogan, J. N. Gregory, Dan Delaney, J. G. Beckerleg and J. W. Harkins were the arch perpetrators and the dear public was the victim, especially the ladies. Demonstrating the Dearborn method of feed water analysis, a sample bottle was given to the visitor, who absorbed the sample unintentionally from the bottom instead of from the top. The booth was trimmed with gladioli and asters and to blot out the iniquities of Harkins and his attendant spirits blotters and lead pencils were provided. Query: Why should a blotter go with a lead pencil?

Detroit Lubricator Co., of Detroit, Mich., arranged multi-feed sight lubricators on a frame well suited to show off the apparatus. Brass specialties of all kinds were also included, the main feature being the Bullseye sight feed oiler for stationary engines, which has no glass to break, and the Bullseye for locomotive which has an extra shutoff for use when standing on siding. The exhibit was in charge of C. H. Crockett.

Graphite Crucibles, Dixon Graphite Greases, Belt Dressing in stick and fluid form, graphite brushes for dynamos, and silica graphite paint were found in the exhibit of the Joseph Dixon Crucible Co., of Jersey City, represented by L. W. Brookes, Dudley Thurston and John A. Condit. Dixon pencils were presented to visitors.

Square, round and elliptical gaskets, having copper shell filled with asbestos elastic cushion, were shown by the Dyna-Como Co., of Boston, represented by C. L. Osborn and W. I. Maude.

All sorts of souvenirs were available at the booth of the Eagle Oil & Supply Co., of Boston, represented by John R. Hamilton and Mrs. Hamilton. Pencil holders, lucky dollars, infernal noise makers and other specialties were in evidence. The exhibit consisted of Perolin Boiler Compound, examples of scale removed by its use, Eagleine oils, Solarine Metal Polish, Eagleine Packings in sheet, spiral and other forms, Skookum Cross Expansion Packing, Eaco Gilsonite Paint and No-Carbon Auto Oil.

Louis Ernst & Sons, of Rochester, representing J. H. Williams & Co., of Brooklyn, N. Y., showed the wrench boards of the latter company, illustrating the action of the Vulcan Bi-jaw and the Williams Ratchet Wrenches. Stephenson Belt Dressing was included in the exhibit also the Perpetual Grip Alligator and Tap Wrenches made by the Edmonds Metzel Mfg. Co., and the Mound packing tools and scrapers made by the Mound Tool & Scraper Co., of St. Louis. Representatives of Ernst & Sons were August Hall, L. E. Ernst, J. L. Ernst and Edward Hart.

Representing the Fairbanks Co., of New York, were Lewis B. Mann, H. Jeffrey, and Mrs. Mann, exhibiting Dart unions arranged in the form of pillars, Oneida steel and wood split pulleys, Fairbanks valves and disks, the Burt exhaust head and other power plant specialties. Gentlemen visitors at the booth were presented with hat brushes and ladies with tape measures and all tested their weight on the company's scales.

Federal Metallic Packings for all purposes were demonstrated at the booth of the Federal Metallic Packing Co. by C. M. Wheaton, H. W. Rand and F. A. DeButts. This packing consists of metallic fibers of special shape coated with a lubricating compound and bound into bundles or braided into sheet form. When used for square or spiral the metal fiber is wound around an asbestos thread and these are gathered. When braided the metal fibers are used for both warp and woof and afterwards a plastic covering is put on and vulcanized in place by the heat. When rods and boxes are in good condition one year is the shortest service guaranteed for the Federal packings. They are made in sheets 1/32, 1/16 and ⅛ in. thick, in rings for ammonia, steam and water, hot or cold, and for vacuum or extreme high pressure work. Tests on the battleship North Dakota have shown service over a long period with steam at 295 lb. at 650 deg. F. and no scoring of the rods.

Ferguson Publishing Co., of New York, represented by A. D. Ferguson, had a booth decorated with copies of the publication Steam.

France Packing Co., of Philadelphia, represented by A. W. France and J. F. Boreland, showed the full line of France metallic sectional packings for long service on piston and valve rods, one sample of packing shown having been in use at the Rochester Cold Storage Co.'s plant over 8 years and never having been removed from the stuffingbox; the rod is still in perfect condition and the packing was to go back into service after the convention. The motto of the France Packing Co. is "No pressure and no temperature too high." Endurol fiber sheet packing for superheated steam was also shown and the France well tip for compressed air pumping. Combination pencils were given to visitors.

Garlock Packing Co., Palmyra, N. Y., in a booth decorated with Boston ferns, displayed a show case of special gaskets, ring and rod packings, square and braided copper packing and other special varieties including the No. 900 white fiber packing for superheated steam. Representing the company were F. P. Morton, F. S. Mosher, F. J. Highmoor, T. C. Green, John N. Todd. Bill folds were presented as souvenirs to delegates.

Blue prints of Goade filters in section, photographs of installations of filters and testimonial letters of the cure of scale by the use of these filters constituted the exhibits in the booth of the Goade Water Filter & Purifier Mfg. Co., of Allentown, Pa. R. J. Goade was in charge of the exhibit.

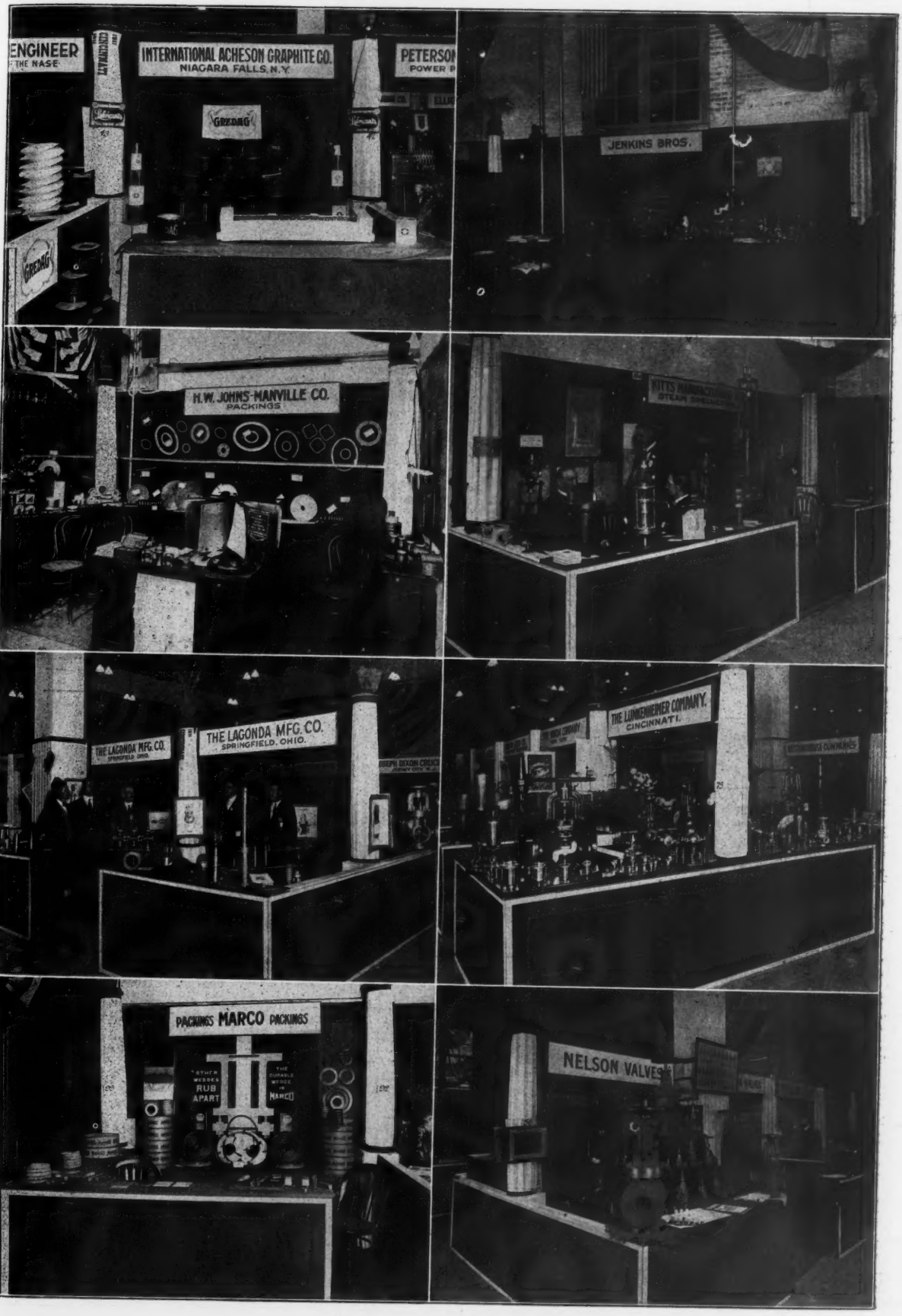
Goulds Mfg. Co., Seneca Falls, N. Y., at Booth 194, was represented by F. T. Wells, H. W. Gumbert, William Allen and O. B. Tanner. In the booth were shown the Simplex belted pump, the Triplex Geared, deep well pump heads and the new Goulds double acting piston pump. The booth was beautifully decorated with pinks and roses.

Gould Storage Battery Co., Depew, N. Y., displayed catalogs describing the construction of the Gould battery.

Samples of Palmetto Packings for steam service and Manhattan Packings for hydraulic service and low pressure steam were exhibited in the booth of Greene, Tweed & Co., New York, in charge of F. E. Ransley and B. M. Bulkley, and were given to visitors. The Favorite Reversible Ratchet Wrench for all services was also displayed.

A record of combustion is given by the Hamler-Eddy smoke recorder showing exactly the density of smoke at the time over which it continues, so that the complete record is made of the firing in the plant. This was shown by the Hamler-Eddy Smoke Recorder Co., of Chicago, in a full sized model operated by means of an electric motor and explained by R. L. Eddy.

At the booth of Haverstick & Co., of Rochester, N. Y., were shown Kewanee unions and fittings made by the National Tube Co., couplings with ball joint for uneven pipe lines, Gard-


INTERNATIONAL ACHESON GRAPHITE CO.
NIAGARA FALLS, N.Y.
JENKINS BROS.
H.W. JOHNS-MANVILLE CO.
PACKINGS
THE LAGONDA MFG. CO.
SPRINGFIELD, OHIO.
THE LUNKENHEIMER COMPANY.
CINCINNATI.
PACKINGS MARCO PACKINGS
RUB APART
NELSON VALVES

ner Governor Co.'s steam pumps, Squires exhaust heads, steam traps, and separators and the Alligator belt lacing. Representatives were Frantz Haverstick, Chas. Hery, Chas. A. Schwonke, Frank E. Lawn, Henry J. Smith, Wm. F. Sullivan, E. M. Keyes.

Hartford Steam Boiler Inspection & Insurance Co. took space in the hall but made no exhibit.

Hawk-Eye Compound Co., of Chicago, represented by H. E. Tibbles, showed its method of analyzing feed water and purification by the use of a solid compound put up in the form of bricks. Other representatives were: W. O. Tibbles, R. M. Rochfort, R. S. Everett, Theo. Brommenschenkel. Visitors were presented with watch fobs showing the Hawk-Eye Compound brick and with blotters.

Hills-McCanna Co., of Chicago, were represented by Robt. E. Hills and T. A. Delaney. In the exhibit were shown low water alarms, gage cocks and force feed oil pumps, including the single feed round type and the 1, 2, 3, 4, and 8-feed square types. Decorations in the booth were Boston ferns mounted on pedestals.

A. R. Foley was at home to visitors in the booth of the Home Rubber Co., of Trenton, N. J., and had decorated his reception parlor with ferns and asters. As usual his booth was infested with flies which were carried away by the visitors. Chas. H. Swoger assisted at the reception. In the booth were displayed N. B. O. Black Sheet Packing and other brands of sheet and rod packings made by the Home Rubber Co. W. J. B. Stokes, president of the company, was present at the convention.

Pure Powdered Graphite and a model of the furnace in which Acheson Graphite is made were shown at the booth of the International Acheson Graphite Co., of Niagara Falls, N. Y. This graphite is artificially made and chemically pure and is used for lubrication either in dry powdered form or in combination with oils and greases. There are 25 to 30 different grades made by controlling the amount of electric current passed through the furnace. A. C. Gibbons and M. A. Smith were present in charge of the exhibit.

A Student's Complete Record, showing progress from a $45 a month job to a $300 per month job was an interesting feature of the exhibit of the International Text Book Co., of Scranton. The reference library furnished by the International Schools was also shown in the bookcase and samples of the instruction papers, drawings, plates and apparatus provided for students. The exhibit was in charge of J. D. Jones, general manager, E. S. Hammond, division superintendent, C. J. Harris, M. Gewurtz and Messrs. V. E., R. A., and H. C. Davidson.

Jenkins Brothers, of New York, showed sectioned models of the new Jenkins extra heavy iron body gate valves, Jenkins globe valves with renewable disk, the Sellers restarting injector, angle valves, the Y blowoff valve with renewable seat and disks, '96 sheet packing with wire insertion, '96 tubular gasket, Jenkins valve disks and the wire valve handle for high pressure steam lines. Representatives at the convention were W. G. LeCompte, H. C. McLaughlin, Billy Murray and Frank Martin.

Representing the H. W. Johns-Manville Co., of New York, were B. C. McClure, H. P. Domine, B. Hausen, E. N. Drew and H. McKinley. Exhibited in the booth, which was lighted with Linolite fittings, were fibrous and asbestos packings including Permanite, Hydraulic, Kearsage High-Pressure Gasket and Sheet Packings, Duo Low-Pressure Packing, Sponge Felt Pipe Coverings, Asbestos and Magnesia Solid and Air Cell coverings, J.-M. Flax Packing and Mogul and Vulcabeston Twist.

A. C. Judd, of Cleveland, O., exhibited metallic and fibrous packings, the metallic packing being filled with graphite for lubrication and suitable for high-pressure, high temperature, high speed and ammonia. With copper shell the packing is suitable for 700 to 1400 deg. F. in temperature. Ring wedge packings for oil pumps were shown, also cage packings and metal ring packings for ammonia machinery and high pressures. The metallic packings are made by the American Huhn Metallic Packing Co. and the fibrous packings were the Janos brand made by Feodor Burgmann. Representatives at the exhibit were A. C. Judd and F. J. Davis.

For the Kennedy Valve Mfg. Co., Elmira, N. Y., William Martin arranged an exhibit of iron and brass valves in globe, gate and swinging check types, also a new type of water gate valve, and took as the motto of the exhibit "30 Years on the Market."

Water softening and water weighing apparatus was shown by the Kennicott Co., of Chicago Heights, Ill., represented by W. T. Runcie, Frank Dunham, T. G. Windes, Jr., and Chas. L. Kennicott. Methods of chemical analysis of water, which is made free, were shown, also blue prints showing the decrease in rapidity of evaporation in a boiler with the accumulation of scale. A model of Kennicott apparatus was shown in operation illustrating the methods of mixing the re-agents, treating the water and settling. In water weighers were shown one for 10,000 lb. per hour and a 15,000 lb. for the United States government.

Lubricants and lubricating devices for using greases were shown by the Kent Lubricating Co., of Milwaukee, Wis., represented by L. H. West, treasurer.

I. D. Lyon, representing the Kerbaux Co., of New York, exhibited Kerbaux high-pressure piston packing, high-pressure sheet packing, hydraulic packing and the Servitor high-pressure sheet packing. All these are packings for modern conditions and consist of asbestos, each fiber of which is lubricated before braiding. Samples of the different packings were given to engineers visiting the booth.

Keystone Greases of different numbers for all lubricating purposes were shown by the Keystone Lubricating Co., of Philadelphia, represented by C. A. Hopper, T. W. Armstrong, H. L. Carpenter, A. D. Page, M. B. Urquhart. Also grease cups for the use of Keystone Grease. The booth was beautifully decorated with palms and cannas and the representatives were busy giving out caps and brushes to visitors.

Kitts Mfg. Co., Oswego, N. Y., represented by Arthur S. Light, T. N. Malcolm, Houston Hill, W. A. Kitts, displayed the Kitts steam specialties including a feed water regulator for controlling water level in boilers which will hold the variation within ⅝-inch, a damper regulator which will hold the boiler pressure within ½ lb., stoker controlling valve for operating mechanical stokers used especially on the Jones Under-feed automatic reducing valve with ball lever, and other devices. Besides this the Rochester vacuum valve for heating systems made by the Rochester Vacuum Valve Co. was exhibited by Arthur S. Light in this booth.

Representing the Lagonda Mfg. Co., Springfield, O., were M. M. Sellers, Jas. H. Johnston, and J. P. Maloy. Revolving heads of the Weinland tube cleaners were shown, also motors suitable for power driving, a large model of the Lagonda automatic cutoff valve for closing steam supply from the boiler or steam inlet to the boiler, reseating machines for the caps of water-tube boilers, and Lagonda Enterprise Multiple Strainers as described in the columns of this issue.

Red Star Boiler Compounds and compound feeders of both the perfected and closed types were shown in the exhibit of the Lake Erie Boiler Compound Co., of Buffalo, by E. C. Schwingel, J. R. Pratt and Geo. J. Juhre. The Ideal pump valves and plunger packings designed especially for hot water and difficult conditions were also included in the exhibit.

In the booth of the Liberty Mfg. Co., of Pittsburg, were H. A. Pastre, sales manager, Henry Weinland, special representative, Karl Sixt and E. L. Davis. The Elliott Co. was represented as well as the Liberty Mfg. Co. and exhibited Liberty specialties including Twin Strainers for cleaning feed water, feed water regulators and pump governors, blowoff valves, reducing valves, steam and oil separators, and steam traps. The Liberty Co. exhibited Liberty tube cleaners and the Norivet cleaner head.

Lippincott Indicators, reducing wheels, and planimeters and detail parts of indicators, showing the construction and method of building them, were displayed by A. C. Lippincott of the Lippincott Steam Specialty & Supply Co., of Newark, N. J. A striking sign was the poster showing "what Lippincott calls a complete indicator outfit" and consisting of planimeter, reducing wheel, indicator, indicator cocks, scales and all other apparatus necessary for taking and measuring indicator cards.

Lloyd Mfg. Co., of Menominee, Mich., was represented by C. N. Dalrymple showing the R. C. blowoff valve.

For the Geo. W. Lord Co., of Philadelphia, there were present Capt. J. E. Doughty, Edward McCarthy, C. W. Phillips and B. L. Lord, explaining Lord's boiler compounds and the method of analyzing feed water to determine the proper kind of treatment. A pamphlet, "Boiler Troubles and Their Treatment," was distributed to visitors, also the Lord Girl calendar. The booth was furnished in mission style and was a popular resting place for delegates. During the convention Mr. McCarthy contributed to the Ladies' Auxiliary $50 which had been provided by the company to be used for whatever purpose should seem to Mr. McCarthy most advisable.

At the booth of the Lunkenheimer Co. a tasteful arrangement of palms and cut flowers gave welcome which was emphasized by the traveling caps with hand and valve charms presented to visitors there. In the exhibit were found sectioned models of Lunkenheimer injectors, cylinder lubricators with 1 and 2 connections, guided gate valves, water columns, with wheel shutoff valves, 4-feed positive force oil pumps, motor-driven to show the actual operation of the apparatus, safety valves, iron body globe and angle valves, Renewo regrinding valves and other Lunkenheimer brass specialties. Representatives at the convention were Lane Thompson, W. W. Beal, A. S. Phillips, Wm. Schmidt, Jr., and E. P. Gould.

For the Lyons Boiler Works, of De Pere, Wis., W. P. Lyons demonstrated the action of the Lyons boiler with his glass model which illustrated the circulation of the water and transformation into steam. Blue prints of settings and of different sizes of boilers were also shown.

Samples of Climax Joint Clamps, Emergency Pipe Clamps, Model Flange Clamps and of the Skinner Valve Reseating Tool were shown by M. B. Skinner at the booth of James McCrea & Co. The Skinner valve reseating tool is a device for quickly repairing leaky valves and comes in 2 sizes, one suitable for valves from ½ to 2 in. and the other for valves from ½ to 3 in. "H H" steam traps, Butman Jointed Flue Cleaner Rods and Century Gasket and Washer Cutters were also shown.

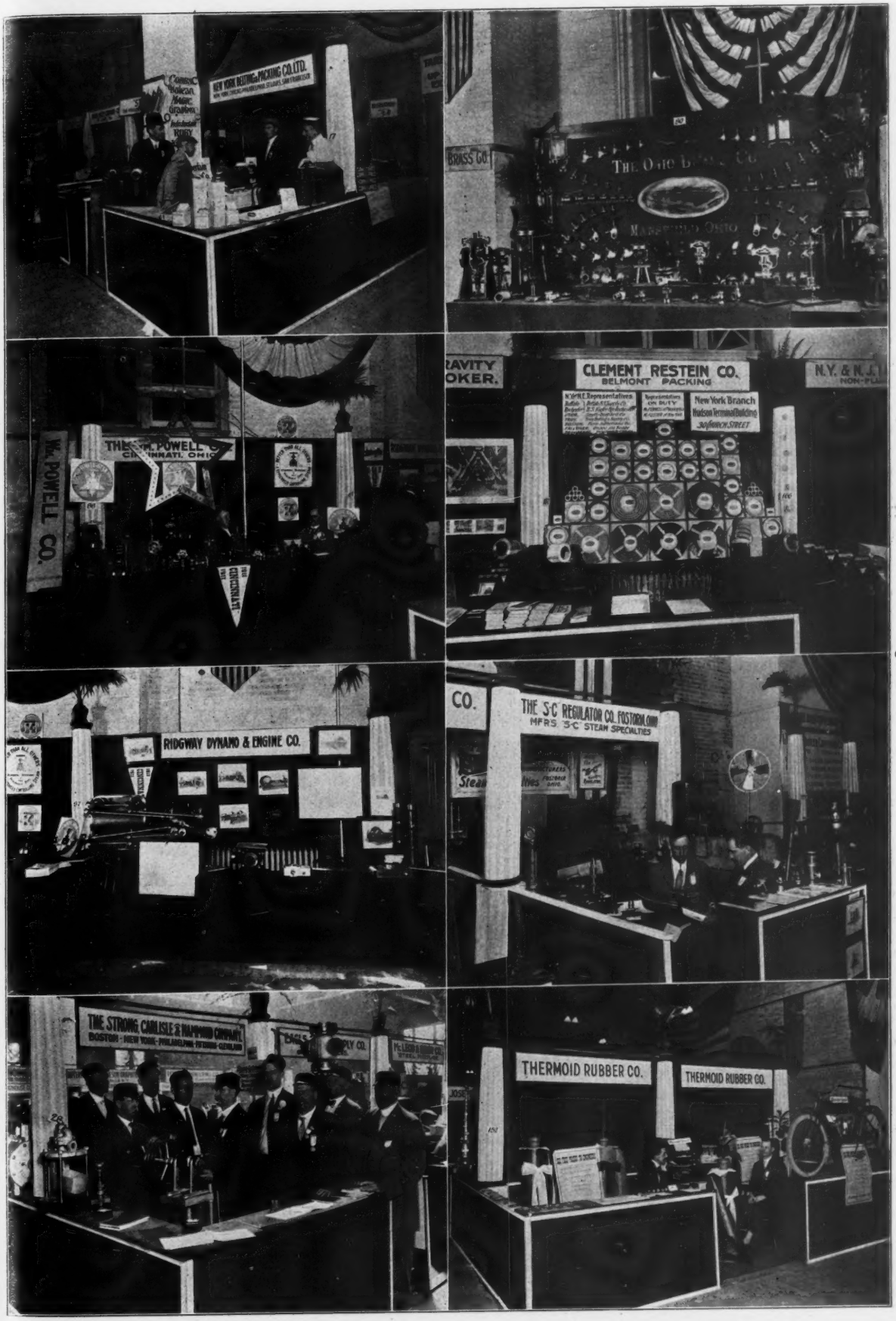
Steel Mixture for boiler door arches and firebox blocks, Foote's Patent Back Combustion Chamber Arch and a model of a Steel Mixture Boiler Setting constituted the display of McLeod & Henry Co., of Troy, N. Y. Chas. N. Morgan, secretary, was present, also "Golden Rule" John H. Foote was playing the shell game with ladies' neck chains.

W. B. McVicker Co., of New York, chemical engineers and manufacturing chemists, were represented by W. B. McVicker and John McDonald, who explained the method of water analysis and showed scientific boiler compounds, lubricants and hydraulic elevator compounds. Bill the watchdog took care of the booth when the others were away and visitors were presented with leather jewel boxes and with drinking cups in leather cases, also with much good advice on the cards handed out, which probably was not followed to any great extent.

Manning, Maxwell & Moore exhibited the product of its 4 manufacturing companies, the Ashcroft Mfg. Co., Consolidated Safety Valve Co., Hancock Inspirator Co., and Hayden & Derby Mfg. Co. Apparatus included were the Ashcroft prismatic water gage, Consolidated Safety Valve in sectioned models, Hancock inspirators shown in like fashion, Ashcroft planimeters and Coffin mean effective pressure computers, Edson recording and alarm gages, inspector's testing outfits, Hancock valves with zero wheels and long screw bonnets. Representing the companies at the convention were L. M. Brigham, Frank J. Corbett, Harry B. Aller, W. P. Bradbury, and C. Monroe Smith.

At the exhibit of the Mason Regulator Co., of Boston, asters and ferns formed the decoration and the exhibit was a line of Mason regulating valves and other specialties, including speed governors, balanced valves and damper regulators. Frank A. Morrison was in charge.

For the Mechanical Rubber Co. R. F. Valentine, H. T. Fryant, Chas. B. Iler and A. C. Conway exhibited Marco packings,


NEW YORK BELTING & PACKING CO. LTD.
BRASS GO
W.A. POWELL CO.
CLEMENT RESTEIN CO.
BELMONT PACKING
New York Branch
Hudson Terminal Building
30th ST. & 6th AVE.
RIDGWAY DYNAMO & ENGINE CO.
THE S-C REGULATOR CO. FOSTORIA OHIO
MFRS S-C STEAM SPECIALTIES
THE STRONG CARLISLE & HAMMOND COMPANY
BOSTON · NEW YORK · PHILADELPHIA · PITTSBURG · CLEVELAND
THERMOID RUBBER CO.
THERMOID RUBBER CO.

explaining the method of forming the diagonal wedge by molding it from a round wrapped roll. Marco sheet packings and spiral and square packings were also displayed. Stein mats were given to the ladies and pipes were provided for the delegates.

For the Michigan Lubricator Co., of Detroit, W. E. Bryant arranged a piping framework in the form of a cross on which were mounted oil cups, grease cups, cylinder lubricators and oil pumps. Special exhibit was the Ball Stop Valve to prevent oil from flowing out of a cup or lubricator when draining the water.

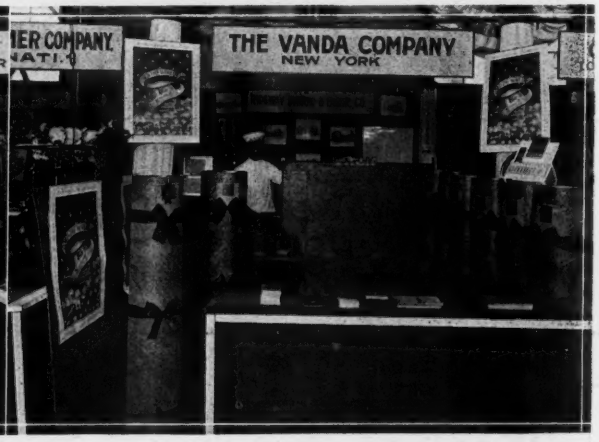
The Mining World of Chicago gave samples of the publication and was represented by J. Winchester Holman and E. L. Rogers.

Iron and brass body Monarch gate valves with loose neck, giving a hammer blow to the wedge in lifting and in closing, were shown by the Monarch Valve & Mfg. Co., of Springfield, Mass., in sizes from ¼-in. to 6-inch. The valves are made up to any size as may be desired by the customer. R. E. Brown was the representative.

Representing the National Engineer were L. L. Rice, Robt. E. Larkin, John W. Lane and W. T. Mug.

Neemes Brothers, of Troy, N. Y., was represented by Spencer Neemes, who showed full sized grates of the shear cutting type with improved removable bars and special lock boxes, also the injector steam blower for increasing boiler draft was shown.

The Nelson Valve Co., of Philadelphia, showed heavy weight products including special valves for superheated steam made with cork handles on the wheels, valve disks cast from Monel metal and stems made from drawn Monel metal. A pyramid display of smaller valves was made, having valves and parts mounted on the 4 sides, surmounted by the Nelson Goddess of Liberty enlightening the convention. Representatives present were: Carlisle Mason, general manager, R. Bonnell, secretary, and New York manager, W. J. Spencer, sales manager, and R. E. Thomas, manager of the Philadelphia office. At the Nelson booth was also C. E. Huxley, showing the Huxley valve, which



is manufactured by the Nelson Co., and has a copper seat held by friction and which is renewed by simply buckling it when it gets scored.

For piston rods the New York Belting & Packing Co., Ltd., of New York, displayed Cobb Magic and Graphon Packings, for gaskets, Indestructible Ruby and Salamander Sheet for high pressures, and Firo Packing for superheat and high pressure, also Turxo Stranded Packing for globe and angle valves. Representing the company were Chas. A. Willhoft, Carl P. Koch and F. E. Friedlander, and delegates were presented with a handsome pocket knife, having 2 blades and special belt punch.

Yankee tools made by North Bros. Mfg. Co., of Philadelphia, were exhibited by F. A. Mutchmore. These included screw drivers in ratchet, plain and spiral forms, automatic drills, spiral drills and automatic hand and breast drills which have 2 speeds, forward and back, and operate with the ratchet either right or left handed, 1 or 2-throw, continuous ratchet action and also locked. Display was made on 3 handsome boards which included a large line of different styles and sizes.

At the booth of the New York & New Jersey Lubricant Co., of New York, Nonfluid oils for all kinds of lubrication were exhibited and a model of the differential gears of an automobile was shown in action, illustrating by Nonfluid oils. Samples were provided for delegates by the representative, J. D. Kelvie.

The Ohio Blower Co., of Cleveland, was represented by H. H. Lind and exhibited the Swartwout line of specialties including exhaust head, centrifugal steam and oil separators, rotary ball bearing ventilators and the Swartwout safety water gage. This was the first public showing of the new Swartwout ball bearing ventilator, which is made to swing with the wind in any direction, can be provided with a glass top if desired, and has the louvres arranged so that the dust is carried outdoors by the current of air.

The Ohio Brass Co., of Mansfield, Ohio, represented by W. T. Jameson and C. N. Allerding, displayed on a handsomely arranged board a full line of brass goods including gage cocks, regulating valves, check and globe valves, unions, radiator valves, also an illuminated view of the works. There were also included the 3 and 4-in. sizes of the Type G pressure reducing valve and Type F in ½-in. to 2-in. for reducing pressure of 250 lb. to from 125 to 25 lb., and the low-pressure reducing valve for reducing pressure of 250 lb. to from 5 to 50 lb., and with low-pressure case to reduce to from 15 to 1 pound. The regrinding gage cock is provided with a babbitt pencil which can be renewed quickly. The Never-Leak gage cock has a piston at the end so that the flow of steam does not commence until the valve is 3/16 in. from the seat.

Ohio cylinder lubricants and methods of lubricating cylinders by the use of grease were shown by the Ohio Grease Lubricant Co., Loudonville, Ohio, represented by F. W. Rogers, J. C. Ross and Geo. A. Mull. Two lubricators were shown in operation and a list given of savings running from 20 to 49 per cent in 20 different cases where the lubricator had been installed.

On the Osborne high-pressure valve a disk is provided at the end of the valve so that the flow of steam or water is cut off before the valve seats. This prevents cutting of the valve face or seat and insures increased life and decreased labor. The high-pressure joints also made by the Osborne High Pressure Joint & Valve Co., of Chicago, have the joint made with a mixture of asbestos and graphite on the inside end of the pipe instead of on the thread. Blue prints were shown of a line equipped with the Osborne fittings and samples of the valves and of the joints. W. L. Osborne represented the company at the convention.

Otis Elevator Co., of New York, distributed phamplets on the Otis traction elevator. The booth was in charge of A. R. Pike.

In the exhibit of the Peerless Rubber Co., of New York, a new line of hose was shown consisting of alternate layers of braided fabric and rubber, the whole mass being vulcanized to a uniform texture so that there is no possibility of skinning the hose and it does not kink easily. Besides this the exhibit included the entire line of packings made by the Peerless Rubber Co., Rainbow Sheet, Eclipse gaskets, Peerless Rod, Rainbesto with asbestos filling, Hercules valve and steam, vacuum and water hose. Stephen Roberts, advertising manager, had provided a big red Rainbow bow for the booth, also handsome enamel watch fobs for the delegates and rubber specialties for the little folks. J. M. Voltz, Chas. Heitzmann, H. L. Brown and Dan Cubberly were also at the booth.

The Penberthy automatic injector and auto-positive injector were shown by sectioned models in the booth of the Penberthy Injector Co., also large sectional drawings of water heaters, automatic water gages and brass specialties. The automatic water gage is provided with a ball valve to close when the glass breaks and the blowoff at the bottom end is controlled by the gage valve without pet cock. In the new type the blowoff pet cock is used and the automatic closing ball valve is retained. Oilers, grease cups and other brass goods were included in the exhibit, which was in charge of Frank O'Leary, assisted by T. E. Robinson.

Peterson Engineering Co., of New York, exhibited in connection with the Richardson-Phenix Co. mechanical lubricating systems including Richardson force feed pumps, Union Cinch pipe fittings, oil filters and reservoirs. Drawings were shown of complete systems and of the methods of connecting up, also the method of using gang sight feeds. The booth was decorated in oleanders and asters and was in charge of J. Wm. Peterson.

Philadelphia Bourse was represented by L. R. Duffield, superintendent, who distributed interesting circular matter in regard to the attractive permanent exhibition of mechanical apparatus which is arranged in the Philadelphia Bourse Building.

For the Philadelphia Grease Mfg. Co., of Philadelphia, T. Addison Collins and H. A. Smith were representatives and exhibited Philadelphia Greases for all purposes with lubricating devices for use of the grease. They explained that Philadelphia Grease is the Quality lubricant and called attention particularly to the Jackson automatic crankpin grease cup which lubricates by means of a plunger operated by the motion of the crankpin.

Jas. A. Donnelley and Chas. A. Fuller represented the Positive Differential System Co., of New York, and exhibited vacuum return line apparatus including the automatic impulse check valve, the Differential check valve and the Jenkins-Donnelley nickel-plated throttling inlet valves.

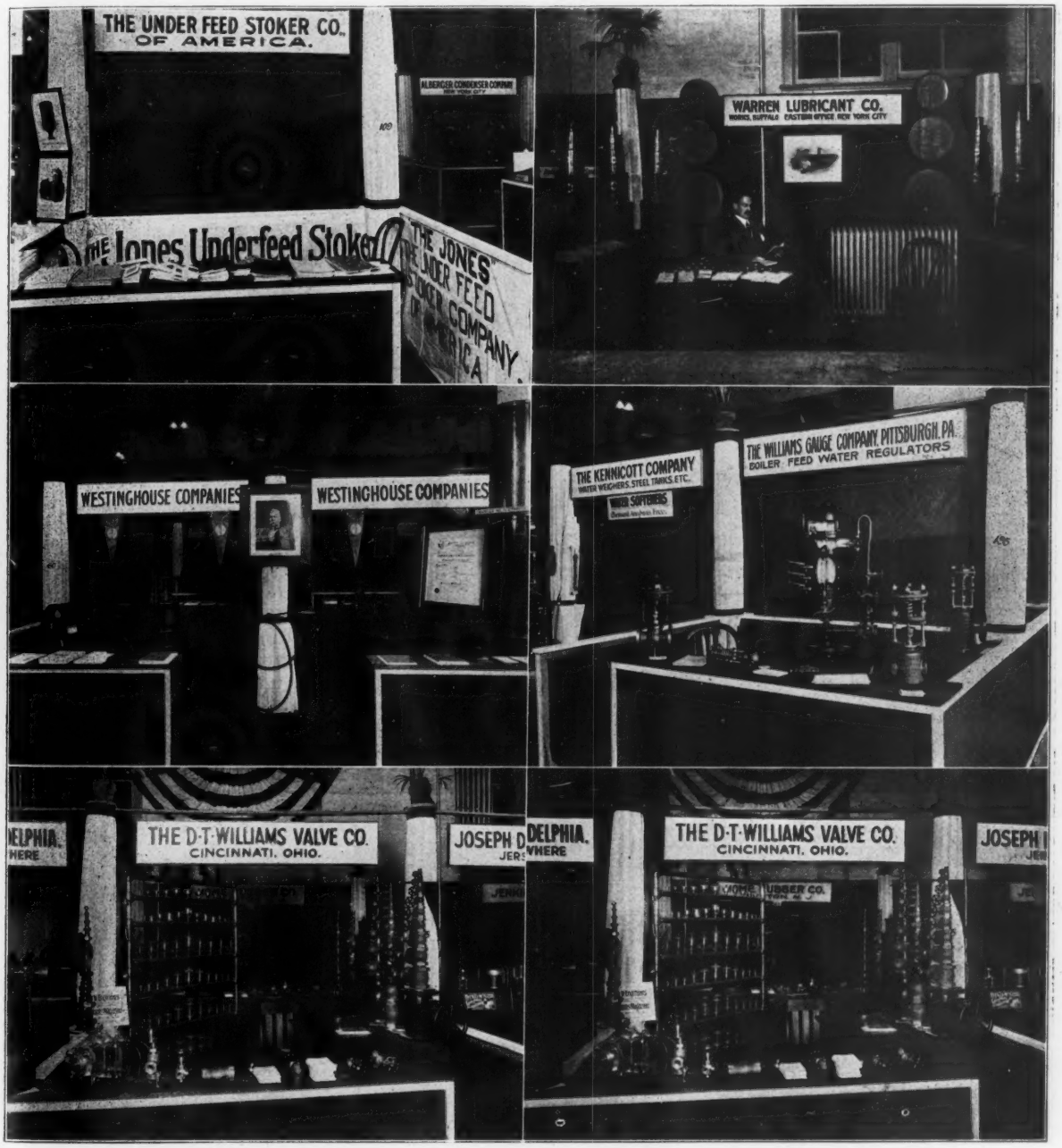
The Hill Publishing Co. was represented by John Hill, Chester W. Dibble, Chas. N. Beard, Wm. Van Kleeck, Fred L. John-

son, J. W. Armour, H. K. Fisher, J. D. Tighe and Jas. T. Vought. Badges were presented to all visitors at the booth.

The White Star was the distinctive feature in decorations at the booth of the William Powell Co., of Cincinnati, to typify the White Star valves with regrinding disk. The White Star was shown both in a transparency and in an illuminated nickel frame as well as on the watch charms and fobs which were presented to delegates. Representing the company were Chas. E. McFarlan, vice president, Chas. Cullin, Randall McFarlan, and W. J. Leonard, displaying besides the White Star valves Union disk valves, Trojan cylinder lubricators, Powell force feed oilers, the Powell blowoff valve and the Powell catalog "Engine Room Needs" was found convenient and was preserved by all engineers who received it.

Belmont expansion packing for steam, stitched hydraulic packings in different styles for pumps and elevator plungers, and open core packing No. 19 for any hydraulic pressure were exhibited by the Clement Restein Co., of Philadelphia. The complete line of packings was described in a catalog given to delegates who were also presented with a watch fob. A. H. Foster and D. D. Fennell were in charge.

Revere Rubber Co., of Chelsea, Mass., showed the various lines of Revere products including Revero, Usudurian, Black Hawk and Hi Heat sheet packings, also Asbestos and No. 1100



Automatic injector. The Powell products are interestingly described in the Blue Book, Catalog No. 9.

For Practical Engineer there were present at the convention E. R. Shaw, Arthur L. Rice, Chas. Sanford Clarke, C. B. Leech, S. W. Anness, John A. Kershaw and H. W. Williams. The directory of exhibits was found a great convenience by visitors to the convention.

Daniels P. P. P. Diagonal Packing, Ebonite Sheet Packing, Valvolite Twist, pump valves, Daniels graded valve grinder for regrinding valve seats by means of emery disks, and other packings and steam specialties made by the Quaker City Rubber Co., of Philadelphia, were exhibited at its booth by the representatives, W. D. Purcell and S. B. Johnston. The for superheat, and in the pump packings Giant, Shawmut and Pilot. Rubber plants formed the decoration of the booth and puzzle squares were presented to visitors. The representatives were J. W. Dudgeon, R. C. Whitmore, E. D. Lombard, and J. W. Lawrence.

Richardson oil pumps, Phenix pumps and Independent oil filters were shown in operation in the booth of the Richardson-Phenix Co., of Milwaukee. Pumps were motor-driven and included 1 and 2-feed round types, 2 and 4-feed square types, 8-feed gang oilers, and a complete oil filtering system with motor and oil tank for gravity feeding. The company was represented by W. E. Richardson, Robert R. Keith and J. S. Ward.

In the exhibit of the Ridgway Dynamo & Engine Co., of Ridgway, Pa., were shown detail parts of the Ridgway 4-valve engine and the full sized accelerating gear connected to valve stems and bonnets, illustrating the quick opening and closing of valves and the dwell during steam admission and exhaust. An interesting feature was the Economy Curves showing the steam consumption for the 4-valve engine and also the steam consumption for different types of engines at different loads. The exhibit was in charge of H. A. Otterson, R. C. Eccleston, M. E. Whitham, and Peter G. Rimmer.

Rochester Rubber Co., which represents the Peerless Rubber Co. in Rochester and vicinity, combined its exhibit with

Ross Valve Mfg. Co., of Troy, N. Y., was represented by Wm. Ross, Adam Ross and J. C. Ross, and exhibited regulating and reducing valves, the Ross filter with details of basket and filtering medium, the Trojan regulator for steam and water, and other Ross specialties.

Jos. T. Ryerson & Sons, Chicago, were represented by D. M. Ryerson, J. T. Corbett, and G. D. Branston. In the booth were exhibited Glyco Bearing Metal and Glyco Patented Skeleton Bearing Construction, Ryerson Hand Flue Cleaner, and a working model of a Continental boiler with Morrison Corrugated Internal Furnace.

that of the Peerless Co. and displayed Honest John hydraulic packing, Arctic Ammonia packing and rubber and canvas belting. The representatives were: H. L. Dusky, F. E. Bigelow, and G. N. Wilkinson.

Wire, Its Manufacture and Uses, was the pamphlet presented by John A. Roebling's Sons Co., of New York, to visitors, and showed the construction of eyelets and hooks, different kinds of iron, steel and copper wire rope and the methods of attaching clamps and swivels. The booth was fitted up as a Turkish parlor and was ornamented with an illuminated view of the new Williamsburg Bridge. The hosts in the booth were John W. Troescher and D. W. Swan.

The Everlasting blowoff valve was shown in various sizes by the Scully Steel & Iron Co., of Chicago. In this the current is straight through, so that there is no cutting of the seat. The Everlasting Steam Trap and Scully Pulley Paste were also part of the exhibit. Representatives were: John H. Allen, F. C. Farnsworth and W. H. Davis.

A miniature steam plant in full operation, having the boiler equipped with the "S-C" water level regulator and the pump controlled by the "S-C" pump governor, was shown by the "S-C" Regulator Co., of Fostoria, Ohio, represented by N. G. Copley and John F. Robertson. Besides these specialties there were on exhibition the new "S-C" damper regulator, the

New Idea Robertson blowoff valve, the Robertson Little Giant tube extractor, the Little Giant steam trap and Kingborn metallic pump valve.

For the Sterling Lubricator Co., of Rochester, John Buckley and F. C. Buckley exhibited force feed lubricators for positive feed of lubricating oil to all bearings. The apparatus shown consisted of a 1-feed piston lubricator, a 2-feed ratchet driven lubricator, a 2-feed lubricator driven by 1 gear and 2-feed with a roller clutch drive, and a 2-feed of 2 gal. capacity. All these were shown in operation driven by an electric motor.

The Sterling Oil Co., of Rochester, exhibited on the second floor a line of lubricating oils and greases in charge of W. B. Beatty, the feature of the exhibit being a brand of automobile oil called the "Mr. Smooth."

The Strong engine stop in actual operation attracted many visitors to the exhibit of Strong, Carlisle & Hammond Co., of Cleveland. This has centrifugal trip, automatic closing valve, bell alarm and test panel, all which were shown as they would be installed in the engine room. Other specialties exhibited were steam traps, vacuum traps, reducing valves, pump governors and the Utility flange wrench for flanges, large valves and taps. The representatives at the booth were L. P. Strong, F. S. Palmer, A. B. Pinney, F. H. Evans, Homer Whelpley, C. H. Camp, and J. C. Murdoch.

Representatives of Southern Engineer at the convention were J. W. Smith and W. S. Cushion, who decorated visitors with cotton field bolls.

C. E. Squires, of the C. E. Squires Co., arranged an exhibit showing the action of a steam trap under 30 lb. air pressure in which, after the air pressure was pumped up, there was no loss except that absorbed by the water in passing through the trap, as the shutoff was complete before any air could escape. During the week Mr. Squires' automobile with the musical horn was frequently seen and heard about the streets of the city. Other specialties shown were the reducing valve, pump governor and feed water regulator manufactured by the company, and besides Mr. Squires, F. S. Evans and C. F. Siegrist were representatives.

Representatives of the Standard Oil Co. were C. A. Salsbury, C. S. Thayer, and G. E. Row, who emphasized the merits of Mobiloil, Standard gas engine oil and Vacuum Arctic Engine oil. Pamphlets on Economy and Lubrication and on the Oil of Giants were distributed.

Features of the Coe Patent Sectional Shaking Grate were the separate bars having inserted sections which avoids all possibility of strains from expansion and permits replacing a section of a bar whenever necessary without disturbing the rest of the grate. The bars are especially heavy in design and are warranted. Two styles of grate are made, the dumping grate for anthracite coal and the shaking grate for bituminous coal, by Geo. H. Thacher & Co., of Albany, N. Y., represented at the convention by C. T. Coe and Geo. H. Thacher, Jr.

Prizes for engineers were shown by the Thermoid Rubber Co. of Trenton, N. J., the terms of the prize contest being given on filling out a blank giving the required information in regard to the plant at which the engineer works. The contest is still open. To everyone who gives the information required a knife for cutting sheet packing is given. To visitors at the booth a glove buttoner was presented. This booth was decorated with rubber plants and contained an instructive exhibit of Solaroid Red Sheet and Blackoid Black Sheet Packings in charge of Fred Kuhl and W. R. McLain.

Trill Indicators in position on 2-way and 3-way cocks were shown in the exhibit of the Trill Indicator Co., of Corry, Pa. These indicators were shown with inside and outside spring, having the Faultless reducing wheel attached and in connection with these was the Trill Quick Acting Planimeter and the Trill Indicator Hook. W. L. Trill and L. T. McElroy were at the booth.

The Publicity Magazine distributed from the booth of the Under-Feed Stoker Co. of America described the construction of the Jones Under-Feed Mechanical Stoker and reports of boiler tests proved what may be accomplished by correct use of the Jones stoker in burning all grades of bituminous coals. The representatives were W. T. Johnson and W. R. Faben.

H. B. Underwood & Co., of Philadelphia, represented by E. J. Rooksby and E. C. Crawford, showed a crankpin turning machine for 7-in. pin in place ready to work, and a boring bar suitable for cylinders 9 in. to 20 in. in diameter, also the St. John self-adjusting steam packing and safety ammonia suction valve which cannot fall into the cylinder, even if the stem breaks.

The Union Oil Works, of Rochester, was represented by M. H. Shea, H. G. Watkins, Howard Smith and F. Ahearn.

In the booth of the U. S. Graphite Co., of Saginaw, Mich., were shown the Mexican graphite ore as it comes from the mine, the different grades of purified and ground graphites, and graphite greases of different consistencies. Automobile and gas engine lubricants, graphite pipe joint compound and a large number of different kinds of lubricating graphites for different purposes were displayed. Appropriately, graphite pencils were presented as souvenirs to visitors. The booth was attractively trimmed with palms, asters and salvias, by Messrs. F. J. Lee and S. W. Southard, who were in charge.

For the Universal Lubricator Co., of Philadelphia, John F. Lewis demonstrated the action of the Philadelphia grease cup which feeds the grease by means of compressed air.

Rolls of Vanda Sheet Packing were the prominent feature at the booth of the Vanda Company, of New York. This is a gray-black packing and the Vanda trade mark was also shown on tubular gaskets for man and hand-hole plates, fiber piston packing and valve stem packing. The Vanda "Black Kid" was in attendance at the booth and presented to visitors a silver mounted watch fob bearing inside a wreath the seal of the N. A. S. E. The company was represented by Hudson Dickerman.

Durabla gaskets, sheet packing and gage glasses, Heather and Hydra piston rod packing and round and flat manhole gaskets were the product shown by R. G. Von Kokeritz & Co., of New York in its booth, which was in charge of J. A. Carson assisted by Harry Wigley.

Spermo Lubricant, in solidified form which has a high fire test and high melting point, was shown by the Warren Lubricant Co., whose representatives were Albert J. Squier, M. M. Sanderson and F. P. Greenlund. A giant paper clip bearing a facsimile of the purple can, which is the trade mark of the Spermo lubricants, was presented to visitors.

In the Westinghouse Companies' booth 3 exhibits were arranged, that of the Westinghouse Air Brake Co., Westinghouse Electric & Mfg. Co., and the Westinghouse Machine Co. The Air Brake Co. made the largest exhibit, consisting of a motor-driven air compressor sectioned to show the operation, the steam-driven air compressor for furnishing air for cleaning about the power plant and an enameled compressed air reservoir. The full line of Westinghouse bulletins was presented to visitors showing mechanical and electrical apparatus, steam turbines, condensers, electric lights, transmission line material, switchboards, Roney stokers and gas and steam engines. Representing the Air Brake Co. were M. H. Burchard and J. B. Wright, for the Electric & Mfg. Co., J. D. Mickle, and for the Machine Co., R. A. Miller and G. D. B. Van Tassel. Silver cuff button souvenirs were distributed.

Operation of the Wickes boiler was shown by a glass topped model in the exhibit of the Wickes Boiler Co., of Saginaw, Mich. The circulation of the water and the boiling into steam were shown perfectly and the construction of various settings for the boiler was illustrated by means of blue prints. James Milne and C. F. Wilson represented the company.

G. H. Williams Co., of Cleveland, illustrated the operation of clam shell and drag scraper buckets by means of aluminum models operated by cords and working exactly like the full sized buckets. G. H. Williams and C. C. Williams were the representatives.

Advantages of the Williams apparatus for controlling the height of water in boilers, giving alarm when the water level gets too high or too low, governing the speed of the boiler feed pumps and testing out the height of water in the boilers made up the exhibit of the Williams Gauge Co., of Pittsburg. These were arranged by C. E. Wolff, Jr., and F. E. Cox, who carried on an active campaign for business during the convention. The gage cock is made with a ball check and a double seat, the check operating so that the ball does not lift until after the valve is part way open. This has a ground fit from the action of stem in turning slightly as the cock is opened and closed, and the double opening action prevents wire drawing of steam across the seat, thus lengthening the life of the valve.

At all times there was lively interest at the booth of the D. T. Williams Valve Co., of Cincinnati, presided over by H. J. Ernst and L. W. Kramer. The exhibit was an interesting collection of brass and iron, regrinding globe, angle, gate and check valves, arranged on a brass pipe frame for the cups, pumps and cocks, and with the unions and valves joined into Totem poles. Delegates were presented with a handsome card case and bill book containing the invitation to come to Cincinnati for 1911.

Wright safety alarm water columns, Wright high-pressure traps and Victor low-pressure traps with Cyclone exhaust heads, solid brass water columns for marine practice and a full line of ball floats for use in traps and water columns constituted the exhibit of the Wright Mfg. Co. of Detroit, and was in charge of H. J. McGregor.

The Ziermore Regulator Co., of Johnsonburg, Pa., was represented by W. E. Zierden, who explained the action of the pressure regulating and controlling devices having an all metal bellows of German silver joined with silver solder, this bellows expanding and contracting with application of pressure on the inside or outside. The principle is applied for the control of reducing valves, pump regulators, control valves for steam pumps and other devices of similar character.

FOR DETERMINING APPROXIMATELY the horsepower capacity of a pump or injector for a boiler whose dimensions are known, the Publicity Magazine gives the following rules: For a plain cylinder boiler multiply the length in feet by the diameter in feet and divide by 6. For flue boilers multiply as before and divide by 4, and for multitubular boilers multiply the length in feet by the square of the diameter in feet and divide by 4.

O'BRIEN STEPPED INTO the door of Casey's engine room one morning and found that worthy member tinkering with a balky pump and swearing softly to himself. Thinking that he saw a good chance to "put one over" on him, he remarked: "Casey, ye'd bether kim over t' th' wather works tomorrer, they air goin' t' pull aff an intherestin' ingineerin' axperimint."

Casey looked up, and being caught off his guard by the innocent look on O'Brien's face, "bit" easily.

"What air they goin' t' do, O'Brien?" he asked.

"They air goin' t' dehorn the hydraulic ram."

And the next moment O'Brien was busy getting out of the door just a few inches ahead of Casey's No. 10 brogan.

IF C. D. will send his name and address to the editors of Practical Engineer his questions will be answered. No attention can be given to letters which are not signed with the name and address of the writer.

NEWS NOTES

FOR THE HANDLING of belting and the manufacturing of Balata and Rubber Belting the Olmsted-Flint Co. has been organized with general sales office at 136 Liberty St., New York City. The incorporators are Willard I. Olmsted, president, Stanley B. Flint, vice president, G. S. Baker, secretary.

F. M. Schiffmacher will be head of the transmission engineering department.

THE FOLLOWING CONTRACTS for the new 2400 hp. boiler plant of the Diamond State Fibre Co. at Bridgeport, Pa. have been placed by F. W. Dean of Boston, their engineer: Building to Frank R. Heavner, Norristown, Pa.; boilers to the Bigelow Co., New Haven, Conn.; induced draft and economizer, to the Green Fuel Economizer Co.; and water heater and purifier, a Cochrane, to the Harrison Safety Boiler Works. Mr. Dean has not yet placed the contract for the coal conveying machinery.

WHAT MAY BE DONE with the Tungsten light in producing a substitute for daylight is evidenced in the new athletic field installed by the Dodge Mfg. Co., Mishawaka, Ind., for its employes. This field is 107 by 122 ft., equipped for tennis, croquet, bowling and quoits, and is surrounded by Tungsten drop lights which make it possible to play the games as readily in the evening as in the daytime.

VERY COMPLETE ARRANGEMENTS have been made by Association No. 4 N. A. S. E. of Worcester, Mass., for the educational work of the coming season. This committee, of which Geo. A. Bartlett is chairman, and the other members Walter Percy, A. W. Davis, S. E. Balcom and C. E. Moore, has recommended that one meeting in each month be given to general discussion on questions brought up by members, one meeting to boiler rules and general education, one meeting to a public lecture, one meeting to the presentation and reading of competitive papers for prizes, and each month in which there are 5 Saturdays shall have one meeting given to the social committee. Also $75 is to be appropriated for the season's educational work. A very complete set of rules has been adopted for the presentation of competitive papers and award of prizes, these rules being carefully thought out to give all members a fair chance at the prizes. Each month a competitive subject will be chosen by the committee and notice given out in advance so that there may be chance for gathering of information on the subject. For October the competitive subject is Boiler Feed Pumps, covering the subject of reciprocating, centrifugal and power-driven pumps, their construction and design, economy of operation and methods of care and operation to obtain best results, making common repairs such as repacking, etc. The work of Worcester No. 4 for the winter should be remarkably effective and interesting.

DREXEL INSTITUTE, Philadelphia, Pa., will open its evening course on Oct. 3 for the session of 1910 and 1911. The schools of engineering and sciences offer electrical engineering, civil engineering and chemistry courses, covering elementary and advanced mathematics, drawing, elementary and advanced electricity, machine design, steam engineering, gas engineering, surveying, design of structures and chemical analysis. Those interested in attending these courses can get full information by applying to the Registrar, 32nd and Chestnut Streets.

IN ORDER better to serve its many customers throughout the South, the International Acheson Graphite Co. has opened a Southern branch in Atlanta, Ga. It is understood the company is pleased with the appreciation shown for its lubricants—Gredag, Oildag, Aquadag, and its pure powdered graphite—by Southern industries.

AT A MEETING of the Executive Committee of the National Gas and Gasoline Engine Trades Association, held in Racine, Wis., August 31st, arrangements were completed for the next convention of the Association to be held in that city, December 12th to 15th inclusive.

The Convention will be held in Dania Hall and there will be the usual exhibition arrangements in this same hall. Mr. O. C. Parker, president of the Reliance Iron and Engine Co., Racine, was appointed chairman of the local committee and will have entire charge of the allotting of exhibition space. Owing to the fact that the space available is somewhat limited, it will be necessary for those who desire to exhibit to make arrangements for same promptly. To the members of the association there will be a charge of $10 for space and to those who are not members the charge will be $15 for space. As the dues of the association are $5 per year, it will no doubt be found advantageous for exhibitors who are not members to take membership and thereby secure membership and exhibition space at the rate of $15. Reservations are being made in the order of receipt of application and remittances.

At the Executive Committee meeting, Messrs. O. C. Parker, H. W. Bolens, of Pt. Washington, Wis., and H. W. Jones of Chicago, were appointed program committee. It is the expectation to have the program feature to some extent along the line of proper equipment of gas engines and accessories, although the program as being arranged for will be, as heretofore, one of wide extent.

The local committee at Racine has arranged for suitable entertainment and a very cordial invitation is extended to anyone who is interested in any form of internal combustion engines to attend the convention. Special arrangements will also be made for the entertainment of ladies who accompany members or visitors and following the precedent at the Cincinnati convention it is desired that a larger number of ladies be in attendance.

THE PAWLING & HARNISCHFEGER CO., Milwaukee, designers and builders of electric traveling cranes and hoists, announce the appointment of Arthur Fritsch, as manager of their Chicago office, in Monadnock Blk., succeeding W. E. Kreamer, resigned. Mr. Fritsch was formerly connected with the Engineering Sales department of the Allis-Chalmers Co.

THE CHRISTIE ENGINE CO. is about starting the erection of a plant at Waterloo, Iowa, and will install in its power plant the engine recently completed for it by the Vilter Mfg. Co., of Milwaukee, Wis. This engine is nearly 30 ft. long, with flywheel 8 ft. in diameter and weighing 8,000 lb. Two cylinders are set in tandem, each 14 in. diameter by 36 in. stroke, and will operate at steam pressure of 200 lb., 150 r.p.m. The principle of this engine, as already explained in Practical Engineer pages, is to mix compressed air with the charge of steam, thus lowering the terminal pressure.

H. W. JOHNS-MANVILLE CO. has recently opened branch offices at Atlanta, Ga., and Rochester, N. Y., for the convenience of customers and to meet growing business in those sections. The Atlanta office is located in the Empire Building, in charge of W. F. Johns, who has traveled that territory for a number of years in the interest of the company, and the Rochester offices are at 725

Chamber of Commerce, in charge of H. P. Domine, formerly with the Buffalo branch of the Johns-Manville Co.

WM. M. CHAMBERLAIN, formerly secretary and treasurer of the Detroit Adcraft Club and general promotion manager for the Detroit Lubricator Co., Wright Mfg Co., and the Austin Separator Co., has been appointed manager of the Bureau of General Promotion for the American Supply & Machinery Manufacturers' Association, with offices in Detroit. He will give counsel to all members of the association in regard to their advertising campaigns.

THE HOMESTEAD VALVE MANUFACTURING CO., of Pittsburg, Pa., has recently opened an office at 1135 Park Row Building, New York City, for the sale of Homestead Valves in that territory. The office is in charge of Frank Boyle, who will be pleased to answer any inquiries. A stock of valves will be carried for prompt delivery.

TO FACILITATE rapidly increasing business in the Middle West, the Rockwell Furnace Co. has opened a branch office in the Fisher Building, Chicago. The office is in charge of A. L. Stevens, an experienced furnace engineer, and will place the company in closer contact with the Western trade, enabling it to give more prompt attention in the future.

BOOKS AND CATALOGS

THE STEAM ENGINE INDICATOR, by W. F. Low, has recently been republished by the McGraw-Hill Book Co. and is a good volume for the operating engineer who wishes to understand how to use the steam engine indicator and to get from it the information that he desires. It has 165 pages with the tables necessary for making computations in regard to indicator diagrams and comes in cloth binding, 6 by 9 in., at a price of $1.50 plus postage.

LATHE GEARING, by W. F. Smith. 6 by 9 in., 16 pages. A book which tells exactly what lathe gears are that are required for any job of thread cutting, so that anyone can figure it out. To those who accept at once a copy can be secured by sending 6 cents postage to W. F. Smith, 1158 W. Hamburg St., Baltimore, Md.

BULLETIN 4760, illustrating and describing a line of direct current instruments constructed upon the D'Arsonval principle and designed for switchboard use, has recently been issued by the General Electric Co. These instruments are neat in appearance, substantially constructed, and accurate. The bulletin illustrations comprise external and internal views of the instruments, showing the details of construction together with dimension diagrams of the instruments and the shunts, and the scales used for different capacities are also shown.

FROM THE RIDGWAY DYNAMO & ENGINE CO., of Ridgway, Pa., comes a finely illustrated catalog showing by clear descriptions and illustrations the general design and details of parts of the new 4-valve Ridgway engine. This has nonreleasing Corliss gear and many special features which will interest those who operate steam engines.

DEAN BROS. STEAM PUMP WORKS, of Indianapolis, Ind., show in an interesting folder the different points of construction embodied in the Dean pumps by means of a talking cross section of the pump, and on the opposite side of the folder is given a table showing the capacity of pumps of given diameter and length of stroke.

CYCLE-HATCHER CO., of Elmira, N. Y., has given a contract to the Syracuse Industrial Gas Co., of Vernon, N. Y., for a new 35-kw. lighting plant which will consist of a 50-hp. gas producer and a gas engine driving a generator direct. This is the second order given by the Hatcher Co. for Syracuse Industrial Gas Co.'s equipment.

THE MAGNOLIA METAL CO. are issuing a Practical Engineer Pocket Book, containing 630 pages, treating on over 2000 engineering and mechanical subjects brought up to date. As this book is one of their advertising mediums they are charging only 40c, which simply covers cost plus postage, and it is of unusual value for the price charged. This book is in the hands of thousands of engineers, who consider it a great bargain and value it as a useful reference work. The company reports a prosperous business, both at home and export, and it will be noted from their advertisement that Magnolia Metal is being used largely on the Panama Canal construction.

ELECTRIC COOKING APPARATUS for hotels and restaurants, publication 3968, recently issued by the General Electric Co., should be of considerable interest to managers of hotels and restaurants, due to the fact that it deals with a subject which is of vital interest to them. It illustrates and describes various appliances designed especially for hotels and restaurant use, for example, broilers, roasting and baking ovens, toasters, plate warmers, stock kettles, automatic egg boilers, etc. A copy of this publication will be forwarded to those interested upon request.

WRIGHT MFG. CO., of Detroit, Mich., in its new catalog No. 12, shows interestingly as well as instructively the construction and operation of the Wright steam specialties, including safety alarm water columns, emergency high-pressure traps, Victor low-pressure traps, Cyclone exhaust heads, filters and scale separators. These are described by means of sectional views, connected diagrams and directions for installing, and lists of dimensions and capacities are also given. It is a catalog which those interested in such specialties will find to their advantage to have on hand.

CONDENSERS FOR SMALL CENTRAL STATIONS is the title of a 24-page pamphlet published by the Wheeler Condenser & Engineering Co., of Carteret, N. J., in which is reprinted a lecture delivered before the Missouri Gas, Electric & Street Railway Association. It contains a number of useful tables, charts and curves relating to the operation and economy of condensing machinery. The effect of vacuum on the steam consumption of simple slide valve, compound, high-speed and low-speed engines and steam turbines is first discussed, and then the other economies to be obtained by using condensing machinery, for instance, the reduction in boiler capacity, are taken up. The text matter is illustrated with 14 figures and curves. Copies of this pamphlet may be had by application to the Wheeler Condenser & Engineering Co., Carteret, N. J.

GENERAL ELECTRIC CO. recently issued a publication devoted to general illumination by its Intensified Arc Lamp, No. 4742, containing description and illustrations in considerable detail of a lamp which the company has designed for general illuminating purposes, which is simple mechanically, and reliable in operation. The principal characteristics of the lamp, however, are its high efficiency and the daylight quality of its light. The publication contains a color chart showing the illuminating values of various forms which compares the incandescent, Welsbach, Nernst and the arc with day light. The Intensified Arc Lamp may be fitted with a diffuser if desired, and is designed

for use on direct current multiple circuits from 100 to 125 volts.

WHY is a striking publication both from the way it is designed and printed and the way in which it shows strongly the advantages of Wear-Well Packings in metallic form and in leather form. Both these are the product of the Detroit Leather Specialty Co., and why they wear well is told in the publication Why which can be secured by writing to the company at Detroit, Mich.

DIRECT AND ALTERNATING CURRENT disk and propeller fan outfits, as made by the Sprague Electric Co., 527 W. 34th St., New York, are shown in Bulletin 235, recently issued. The construction of the outfits as well as capacities in cubic feet of air per minute, and dimensions are given in the bulletin. A folder from the same company also describes portable electric drills for direct or alternating current.

ROCHESTER MOTORS as made by the Rochester Electric Motor Co., Rochester, N. Y., are the subjects of a bulletin showing the construction in detail and applications.

PEERLESS BELTING, HOSE AND PACKINGS, including Rainbow, Peerless, Eclipse and other brands, are shown in an interesting folder recently sent out by the Peerless Rubber Mfg. Co., 16 Warren St., New York.

WHEN INSTALLING A FURNACE it is necessary always to have some kind of a lining which will stand the high temperature needed to make combustion a success. Fire brick is the material ordinarily used and the advantages of the Betson Plastic Fire Brick are set forth in pamphlets and cards send out by the Betson Plastic Fire Brick Co., of Rome, N. Y. These give the reasons why this fire brick makes good lining and testimonials from those who have used it.

THE GENERAL ELECTRIC CO. has recently issued the following bulletins, copies of which will be furnished to readers of Practical Engineer upon request:

Bulletin 4767 illustrates and describes motors designed particularly for use in steel mills. Among them are the 6000 hp. 6600 volt induction motors recently installed in the Gary plant of the Indiana Steel Co. The bulletin refers to both alternating and direct current motors.

Bulletin 4749 on Alternating Current Switchboard Panels will prove of interest and great assistance to any one considering purchase of switchboard panels. The panels illustrated in this bulletin are of the sectionalized type, and each section has a separate catalog number. These panels are in three sections, and the pages of the bulletin are sectionalized so that the user may have before him a picture of the complete panel desired, together with a full description of the equipment.

Bulletin 4755 illustrates and describes the electrical equipment of the Great Northern Railway. The part electrified is a section of the main line which includes the tunnel through the summit of the Cascade Mountains. The difficulties encountered before the electrification, and the manner in which they were overcome later, are told, and as these conditions are common to most of our trunk lines, the Great Northern electric system is of interest as an object lesson.

Portable Substations are described in bulletin 4746. These are for supply of intermittent power for electric roads, and to provide for a temporary supply of power in case of accidents at substations equipped with only one rotary converter unit. The station consists of a specially arranged car containing a complete substation equipment and may be conveniently moved to any section of the line temporarily requiring power.

Bulletin 4764 illustrates and describes a line of Mazda compensator and low volt lamps. Conpensator lamps may be used to advantage where small units of light are employed, or in connection with gasoline engine-driven generating sets, and particularly where the lamps are frequently moved about and subjected to jars. They are also used in connection with ornamental street lighting, and when so used are operated on the standard multiple circuit in connection with a compensator which is installed in the base of the pole. The bulletin contains data relative to the cost of operating these lamps and shows a diagram of connections.

Bulletin 4754 describes in considerable detail the General Electric Company's continuous-current and alternating-current motors for use in steel mills, and similar places, in connection with cranes, hoists, and other apparatus. The bulletin contains dimension diagrams of all the motors to which it refers.

In bulletin 4758 there is described a lamp which has contributed and will contribute in still greater degree to the increase in the sign method of advertising. This bulletin is devoted to Mazda sign lamps and contains a statement of the characteristics of these lamps, wiring diagrams showing the method of changing regular multiple sign wiring to series for Mazda sign lamps, and other wiring methods used with these lamps. It contains tables giving the size of wire for feeders, with different arrangements of lamps; interesting data on comparative cost of electric signs, illuminated by carbon and by Mazda lamps.

Thomson polyphase watthour meters which are made for the specific purpose of measuring energy in any 2-phase, 3-phase, or monocyclic circuit, are described in bulletin 4762. These meters may be applied to a circuit carrying a mixed load of lamps, motors or other translating devices, and will record accurately, irrespective of unbalanced load conditions.

STRONG STEAM SAVERS and Protective Devices are fully illustrated and described in a handsome catalog just received from the Strong, Carlisle & Hammond Co. of Cleveland. Everybody who is interested in the economy and safety of power plants will find this catalog of great value.

TRADE NOTES

IN HANDLING DIFFICULT bearings the experience of the Carl Anderson Co. of Chicago will be helpful: "We use your Mica Flake Lubricant for a fan that we rebabbited, and which runs under very difficult circumstances. We could not get it to run cool with anything else, but tried your Mica Flake and our troubles ceased, and we now use it regularly." Mica Flake is made by the United States Mica Co. of Chicago.

YORK MANUFACTURING CO. reports the following recent sales: Rectors Hotel, New York City, 2 25-ton absorption refrigerating machines, 6-ton ice plant and refrigerating piping; Pittsburg Mercantile Co., Woodlawn, Pa., 1 8-ton refrigerating plant; United Iron Works, Oakland, Calif., 1 4-ton refrigerating plant for the Samuel Merritts Hospital, Oakland, Cal.; Grunewald Hotel, New Orleans, La., 1 35-ton refrigerating plant, and 10-ton freezing and distilling system; H. B. White, Olathe, Kans., 1 1-ton

refrigerating plant; Covington Brewing Co., Covington, Ky., 1 17-ton high-pressure side; The Kent Co., Ltd., Montreal, Canada, 1 4-ton refrigerating plant for the Rideau Club, Ottawa, Canada; Martinique Hotel, New York City, 2 35-ton refrigerating machines, 6-ton freezing system and brine piping for boxes; Sam Friedman, Savannah, Ga., 1 17-ton refrigerating machine and 4-ton ice making plant; S. P. Pond Co., Chillicothe, Mo., 1 20-ton compression side and direct expansion piping; Homeopathic Hospital, Rochester, N. Y., 14-ton refrigerating plant; Asheville School, Asheville, N. C., 1 2-ton refrigerating plant; St. Edwards College, Austin, Texas, 1 4-ton refrigerating plant; F. Schenk & Sons Co., Wheeling, W. Va., 1 11-ton refrigerating plant; Ohio Agricultural Experiment Station, Wooster, Ohio, 1 17-ton refrigerating plant; Union League, Philadelphia, Pa., 1 35-ton compression side, 6-ton freezing system and piping for boxes; Mexico North Western Railroad, New York, N. Y., 1 6-ton refrigerating and ice making plant; Wm. S. Patten, South Natick, Mass., 1 1-ton refrigerating plant; Wyoming Ice & Cold Storage Co., Wyoming, Del., 1 20-ton plate ice-making plant.

THE OHIO BLOWER CO. of Cleveland, Ohio, report sales of 35 Swartwout cast-iron exhaust heads during the month of August, among the purchasers may be mentioned the Republic Engineering and Construction Co., Buffalo, N. Y.; Lembeck & Detz Eagle Brewing Co., Jersey City, N. J.; Park Brewing Co., Hancock, Mich.; Central Union Gas Co., New York City; Toledo Railways & Light Co., Toledo, Ohio; Knox Automobile Co., Armory, Mass.; The American Agricultural Chemical Co., Detroit, Mich.; French Lick Springs Hotel, French Lick, Ind.; Dells Paper & Pulp Co., Eau Claire, Wis.; Youngstown Sheet & Tube Co., Youngstown, Ohio; General Fire Extinguisher Co., New Orleans, La.; Star Palace Laundry Co., Rochester, N. Y.; Nittany Light, Heat & Power Co., Lemont, Center County, Pa.; and Technical High School, Harrisburg, Pa.

ACTUAL PRACTICE IS PROVING the power economy of the Ohio slow speed dust collecting system, manufactured by the Ohio Blower Co. of Cleveland, Ohio, the E. M. Hulse Co. of Columbus having recently placed their second order and the Ferro Machine & Foundry Co. of Cleveland their third. Other concerns who have recently placed orders for this system are The Peerless Motor Car Co., Cleveland, Ohio; The Showers Bros. Co., Bloomfield, Ind.; Breed-Johnson Furniture Co., Jamestown, N. Y.; Mills-Creton Careton Lbr. Co., Cleveland, Ohio; Ferro Machine & Fdy. Co., Cleveland, Ohio; McCrillis Handle Co., Norwalk, Ohio; Cleveland Foundry Co., Cleveland, Ohio; White Sewing Machine Co., Cleveland, Ohio.

DURING THE PAST MONTH the Ohio Blower Co. of Cleveland, Ohio, report sales of Swartwout centrifugal steam and oil separators to Compressed Air Machinery Co., San Francisco, Cal.; Wilkesbarre Anthracite Coal Co., Wilkesbarre, Pa.; West Bay City Sugar Co., Bay City, Mich.; Whiting Mfg. Co., Abington, Va.; Toledo Railways and Light Co., Toledo, Ohio; Hammermill Paper Co., Erie, Pa.; Durham Traction Co., Durham, N. C.; The American Separator Co., Bainbridge, N. Y.; R. J. Reynolds Tobacco Co., Winston-Salem, N. C.; The Lumsden & Van Stone Co., Southbridge, Mass.; Knight & Wall Co., Tampa, Fla.; General Fire Extinguisher Co., New Orleans, La.; E. M. Freese & Co., Galion, Ohio; George H. St. Clair, Iron River, Mich.; Dry Milk Co., Maywood, N. Y.; M. E. Lewis, Lestershire, N. Y.; and Eastern Michigan Edison Co., Mt. Clemens, Mich.

THE ACCOMPANYING ILLUSTRATION shows the exhibit of the Penn Oil & Supply Co., Ltd., of Minneapolis, at the convention of engineers recently held in Minneapolis. This company by its honest business methods and the excellency of its oils, which are manufactured from pure Pennsylvania petroleum at

its Oil City, Pennsylvania, refinery, is ranked high among the leading independent oil companies of the northwest. These oils are prepared to lubricate in a scientific manner any machinery from a threshing machine to an aeroplane.

LAGONDA MANUFACTURING CO., of Springfield, Ohio, announces that it has bought out the Enterprise Machine Manufacturing Co., acquiring the rights and patents for the full line of water strainers and tube cleaners manufactured by the latter. Special attention is being paid to the development of the water strainer. Although this strainer has been on the market for several years and is well beyond the experimental stage, the Lagonda Manufacturing Co. has made several important improvements and the apparatus is now known as the Lagonda-Enterprise Strainer. This strainer is suitable for removing impurities from boiler feed water, circulating water, etc.

THE U. S. INDESTRUCTIBLE GASKET CO., Hudson Terminal, New York, are building a new plant in Brooklyn, N. Y., which will have a space for machines equal to 10 ft. wide and 500 ft. long. The building is of semi-fireproof constructions, steel sash being used, and well lighted. This new plant affords greatly increased facilities for the manufacture of their products, consisting of Gaskets, Washers, Disks, Rings, Diaphragms, Multiple Disk Valves, Stamping, Formings, Punchings, Dies and Specialties of all kinds, made of Copper, Lead, Steel, Bronze, Indestructible, Ames Alloy, Norway and Swedish Iron, Monel Metal, Sparkite, Copper-asbestos, Wire, paper fiber, asbestos, leather, cork, mica, rawhide felt, canvas, etc., of every size, shape and thickness.

REPEAT ORDERS FOR Swartwout steam specialties have recently been received by the Ohio Blower Co., Cleveland, from Louisville Lighting Co., Louisville, Ky.; The Hartman Stock Farm Co., So. Columbus, Ohio.; E. M. F. Co., Detroit, Mich.; and the National Coal Co., Byesville, Ohio.

PRACTICAL ENGINEER CLASSIFIED ADVERTISEMENTS

Advertisements in this section are inserted under regular headings at the rates of 40 cents per line. About nine words make a line. No display type allowed, but the first three words may be set in capital letters. Minimum space sold, two lines.

Under classification, "Positions Wanted," advertisements not exceeding four lines will be inserted for subscribers once free of charge.

To insure proper classification, copy must reach this office on or before the 15th of month preceding publication.

Positions Wanted

POSITION WANTED—Chief Engineer desires change of position; at liberty Dec. 1st; with present firm 4 years; strictly sober, good references; correspondence solicited. Adderss F. E. Douglas, Poland Spring House, South Poland, Maine. 10-1.

POSITION WANTED—As assistant engineer or helper in electric light or power plant. Age 19. Best of references, sober and reliable. Has an I. C. S. education with a little experience. Address Rollin L. Hall, Cassopolis, Mich. 10-1

POSITION WANTED—As engineer in a small plant, or as hoisting engineer. Have had several years' experience. Position in South preferred. Address Box 79, Quitman, Miss. 10-1

POSITION WANTED—By young married man who has full charge of lighting plant at present. Has Ohio license. Will go any place that position and salary justify. References. Address Box 141, Practical Engineer, Chicago, Ill. 9-5

POSITION WANTED—By young man, 18 years of age, as assistant engineer, fireman or oiler; 3 years' experience with engines, boilers and dynamos. Am engineer on dredge boat at present. Best of references. Address Box 143, Practical Engineer, Chicago, Ill. 9-2

POSITION WANTED—As chief engineer. Have had eighteen years' experience with steam and electrical work in central stations. Would like a position in the southwest. Moral habits. A-1 references. Address Box 142, Practical Engineer, Chicago, Ill. 9-2

Help Wanted

WANTED—LIVE, HUSTLING SALESMAN to call on engineers to sell a widely advertised oil filter. Good commissions. Address Box 152, Practical Engineer, Chicago, Ill. 10-2

WANTED SALESMAN—Calling on plants using steam for power, to carry an easy selling article as a side line. Can be carried in pocket. Good commission. Address Box 151, Practical Engineer, Chicago, Ill. 10-2

WANTED—A FIRST-CLASS foreman for a plant that manufactures hardware specialties, stove trimmings, stove bolts, rivets, etc. Address Box 153, Practical Engineer, Chicago, Ill. 10-1

WANTED SALESMAN—Calling on power plants and factories where belting is used, to sell guaranteed Pulley Wheel Facing; eliminating all belt dressings; saves from 10 to 35 per cent in power. Virgin territory is open for live agents. Argo Supply Co., 136 Liberty St., New York, N. Y. 10-2

WE HAVE a stunning proposition for an engineer in every town or city. Little time required. Will not interfere with regular work. Write for particulars. Address Box 136, Practical Engineer. 8-tf

GOOD RELIABLE PARTY with small capital to invest in good, patentable wood-working machine. This machine is a great time saver and there is a large field for a machine of this kind. For full particulars write to 1613 24th St., Two Rivers, Wis. 9-2

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